IVISION OF FISH AND GAME OF CALIFORNIA
BUREAU OF COMMERCIAL FISHERIES

FISH BULLETIN No. 49

The Commercial Fish Catch of California for the Year 1935

By the Staff of the
BUREAU OF COMMERCIAL FISHERIES

339

MAP OF
CALIFORNIA
SHOWING THE
EIGHT STATISTICAL REGIONS
N
REGION 10
DEL NORTE
TRINIDAD HD.
HUMBOLDT
REGION 20
MENDOCINO
GLENN
LAKE
COLUSA
REGION 30
PT. ARENA
SONOMA
YOLO
NAPA
SOLANO
SACRAMENTO
REGION 40
MARIN
SAN FRANCISCO
CONTRA COSTA
SAN JOAQUIN
ALAMEDA
PACIFIC
PIGEON PT.
SANTA CRUZ
SANTA CLARA
REGION 50
SAN BENITO
MONTEREY
PIEDRAS BLANCAS
SAN LUIS OBISPO
REGION 60
SANTA BARBARA
VENTURA
LOS ANGELES
PT. DUME
REGION 70
ORANGE
RIVERSIDE
SAN MATEO PT.
REGION 80
SAN DIEGO
IMPERIAL

FIG. 1.

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FOREWORD

Fifth in a series of bulletins dealing expressly with the commercial fish landings in California, this issue is designed as a reference book for the administrators. Its purpose is to gather in one place a set of graphic charts covering the fluctuations in the catch of each commercial species for the years 1916–1935, inclusive. The observations in the articles accompanying each graph are the contributions of the individual staff members of the Bureau of Commercial Fisheries of the California Division of Fish and Game.

The statistical data for the tables and graphs have been collected through the state's statistical system, with every member of the Bureau participating and striving for accuracy. The methods employed in collecting and tabulating the fisheries statistics have been described in the Division's Fish Bulletin 44 (1935).

We acknowledge with appreciation the contributions of two federal representatives. Mr. Carl B. Tendick, agent, U. S. Bureau of Fisheries, who has maintained headquarters at the California State Fisheries Laboratory for about seven years, has presented a paper on the value of the commercial fishery products of California, the data having been gleaned from the state's records. Mr. Stevan S. Pavitt, draftsman, under a project of the Works Progress Administration, has drawn the graphic charts for the bulletin.

September, 1936.

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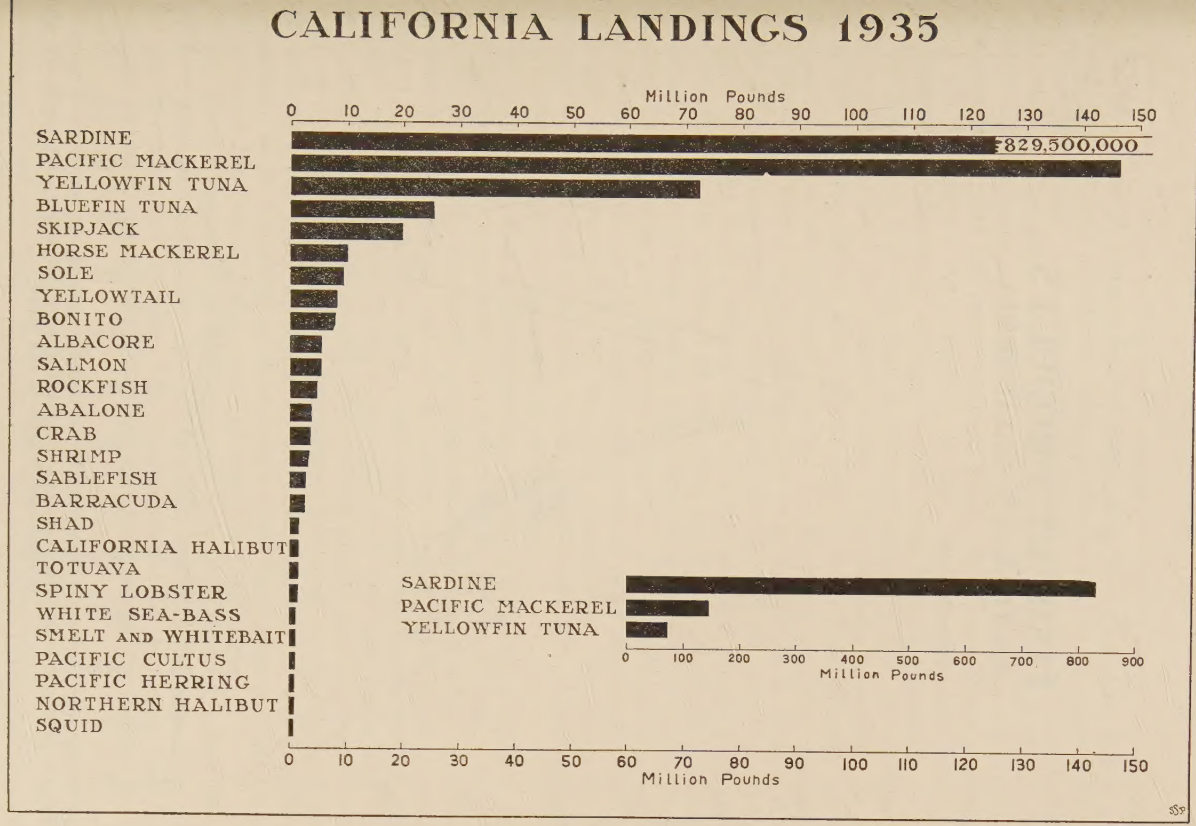
CALIFORNIA LANDINGS 1935
Million Pounds
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
SARDINE
PACIFIC MACKEREL
YELLOWFIN TUNA
BLUEFIN TUNA
SKIPJACK
HORSE MACKEREL
SOLE
YELLOWTAIL
BONITO
ALBACORE
SALMON
ROCKFISH
ABALONE
CRAB
SHRIMP
SABLEFISH
BARRACUDA
SHAD
CALIFORNIA HALIBUT
TOTUAVA
SPINY LOBSTER
WHITE SEA-BASS
SMELT AND WHITEBAIT
PACIFIC CULTUS
PACIFIC HERRING
NORTHERN HALIBUT
SQUID
$29,500,000
SARDINE
PACIFIC MACKEREL
YELLOWFIN TUNA
0 100 200 300 400 500 600 700 800 900
Million Pounds
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Million Pounds

FIG. 2.

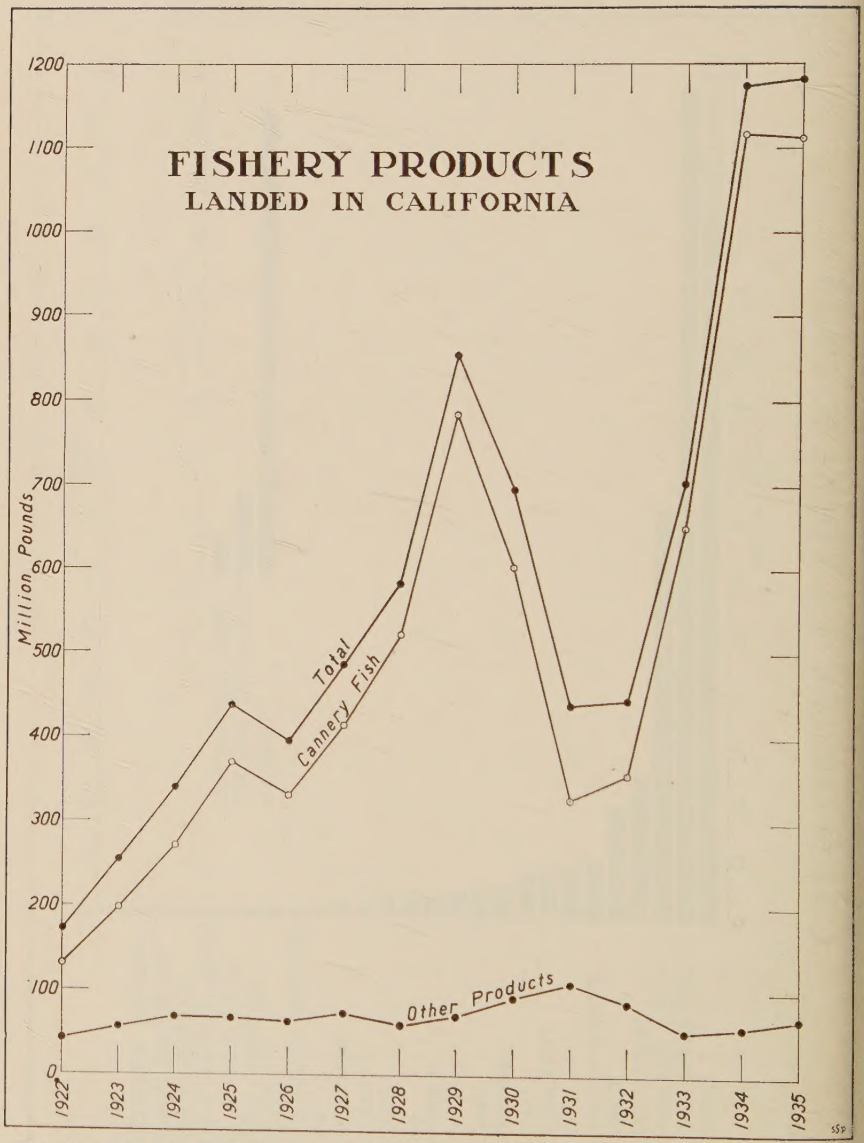

FIG. 3. Fish delivered to canneries contrasted with all other fish, mollusks and crustaceans landed in the state.

CALIFORNIA CANNED FISH

California with a coast line of more than one thousand miles has a bewildering variety of marine fishes and more than a hundred kinds are utilized for food with about forty kinds ranking as commercially important. The ocean waters off California comprise one of the great fish-producing areas of the world, but we make a mistake if we jump to the conclusion that the forty kinds of fishes mentioned above are caught in great quantity. As a matter of fact, four species, not forty, are responsible for the huge tonnage landed each year in the state.

The fish catch depends upon large numbers of people to eat the fish. The western half of the United States is not densely populated so that no great quantity of sea food can be sold in fresh fish markets, nor can the marine products be frozen or salted for shipment in great quantities. The great centers of population are far away so that both time and distance intervene between the source of the fish supply and the ultimate consumer. This is the reason why we have adopted canning of fish as the solution to the problem of shipping sea foods to distant markets. Canning, then, is the key to an understanding of the fish catch of this state and as canning goes, so goes the catch. The quantities of sea foods sold locally do not change much from year to year except gradually to increase with the growth of the local population. By contrast, the amount of fish used for canning varies greatly with the general economic conditions throughout the country as a whole.

The operation of a modern canning plant is dependent upon a large and fairly steady supply of raw materials at moderate cost. It is for this reason that we choose for canning those species of fishes which congregate in large schools and can be captured cheaply in great quantity. On our coast, the sardine best meets this need for a densely schooling species. In addition to being a splendid food fish that packs and ships well, the sardine is rich in valuable oil that can be recovered at low cost and as a result the tonnage of sardines delivered in the state is more than double the total landings of all other species of fish combined. Obviously then, the trend of the sardine catch from year to year largely determines the trend of the total fish catch in California.

The Pacific mackerel is another small fish of high food value, occurring in quantity along the California coast, and this fish schools so that it can be captured cheaply. In recent years the mackerel has been canned in such quantities that this species now ranks second in the state's fish catch.

Our five tunas are larger fishes which normally are not found in such dense schools so that the cost of capture is greater. Two of the five species of tuna are taken in quantity, the yellowfin tuna and the skipjack; and these two tunas with sardines and mackerel make up the four species that are responsible for the bulk of the cannery catch. By comparison with these four species, the amounts of bluefin tuna, albacore, bonito, yellowtail and squid used for canning are minor.

POUNDS OF FISHERY PRODUCTS LANDED IN CALIFORNIA

Year	*Cannery fish*	*Percentage of cannery fish to total*	*Other products*	*Total pounds*
1922	130,930,000	72	51,300,000	182,230,000
1923	197,970,000	78	55,780,000	253,750,000
1924	272,050,000	80	68,040,000	340,090,000
1925	370,070,000	85	67,070,000	437,140,000
1926	332,380,000	84	62,330,000	394,710,000
1927	413,490,000	85	73,230,000	486,720,000
1928	522,560,000	90	60,510,000	583,070,000
1929	785,250,000	92	72,010,000	857,260,000
1930	603,210,000	87	92,890,000	696,100,000
1931	326,610,000	74	111,950,000	438,560,000
1932	357,530,000	80	87,930,000	445,460,000
1933	651,280,000	92	53,760,000	705,040,000
1934	1,115,320,000	95	58,990,000	1,174,310,000
1935	1,112,490,000	94	68,960,000	1,181,450,000

During the five-year interval, 1931–1935, a little less than four billion pounds of fish, mollusks and crustaceans were landed in California. Of this amount, 90 per cent were landed at canning plants. In other words, the amount of fish delivered at canneries was more than nine times greater than the total of all fish, mollusks and crustaceans sold fresh, frozen and salted during the five years. With the increased canning of sardines, mackerel and tuna during the last two years (1934–1935) the cannery catch has been about eighteen times greater than all other fishery products of the state—*W. L. Scofield.*

References (see page 164) : 10, 11, 12, 13, 54.

CALIFORNIA'S SARDINE CATCH

This is the story of a war baby that grew to be a giant. Before 1916, the sardine catch was scarcely worth mentioning but during the World War fat contracts for European delivery of canned sardines stimulated what we then thought to be a large fishery, yet the big catches of the war years (1917–1919) now seem small by comparison with the recent developments in this state. The end of the war cancelled many contracts for canned fish and the post-war business slump was directly reflected in the falling off of our sardine catch.

After the lean years of 1921 and 1922, there gradually developed a sale for case goods in Latin-American and Asiatic countries. During this recovery period the utilization of sardine offal became more general because the fish scrap, that formerly had been dumped at sea, was found to yield products that had ready sale at a profit. The sardine oil from offal was sold for use in the preparation of paint and soap, and the dried fish scrap or fish meal sold as food for chickens and fertilizer for orange groves. This utilization of by-products became increasingly profitable till the canning of sardines became almost a sideline to the meal and oil business. The profit from the sale of the oil was so attractive that canned sardines frequently were sold below cost of production so that more offal would increase the revenue from sardine oil. Fish meal paid most of the cost of the reduction process and the oil was "velvet." This led to a demand for special permits to use whole fish for oil rather than for canning, and the state legislature yielded step by step to this demand. In consequence the annual catch of sardines steadily rose from 1921 to 1929, when the depression knocked the props from under nearly all business undertakings and the sardine catch slumped for the next two years. (See Fig. 4.) The bottom did not drop out for there was still a profit to be made in sardine oil and a domestic consumption of the canned goods was developed through improvements made in the product. The depression slump was not so low and recovery was quicker than in most other business and 1932 saw a turn upward of the tide. The tide turned into a flood resulting in a sardine catch of such magnitude that it ranks with the great fisheries of the world.

The ready money in sardine oil attracted the attention of business men other than fish canners. During the fishing season of 1930–1931, we beheld the strange sight of a ship fitted up as a sardine reduction plant that would anchor beyond the three-mile limit and outside the jurisdiction of state laws, where sardine oil could be produced without the bother of operating a cannery. In the following years other ships were added till there is now a small fleet of floating reduction plants and the tonnage of sardines delivered to off-shore ships alone has mounted to a total about double the entire state catch of the boom days during the World War. (See Fig. 5.) This catch delivered off shore

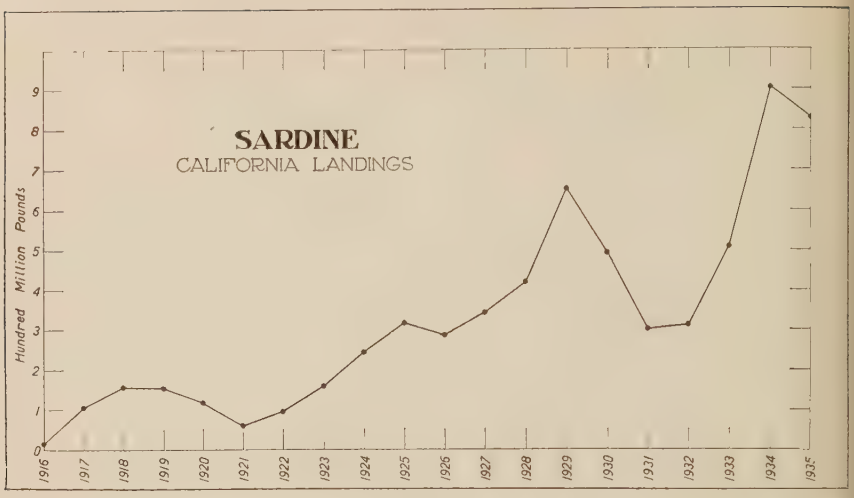

FIG. 4.

added to the tonnage landed at the canneries makes a total that is truly staggering, and we all wonder how long such a harvest can continue before the shortage of raw material becomes acute.

The magnitude of the tuna catch of California is fairly well known and our mackerel catch exceeds that of the entire Atlantic coast of America, yet our sardine total is more than double our catch of all other species of fish, mollusks and crustaceans combined. The figures seem fantastic. Last fishing season (1935–1936) we caught sardines at the rate of more than 1500 tons a day for every day in the year or 65 tons per hour. This is more than a ton a minute for every minute of the 365 days. Translating tons into numbers of fish, we captured sardines at a rate exceeding 11 million fish per day throughout the year. That is nearly a half million fish per hour or 130 fish per second for every second in a whole year. During the fishing season more than 4 billion sardines were caught, making 568,430 tons of fish delivered to

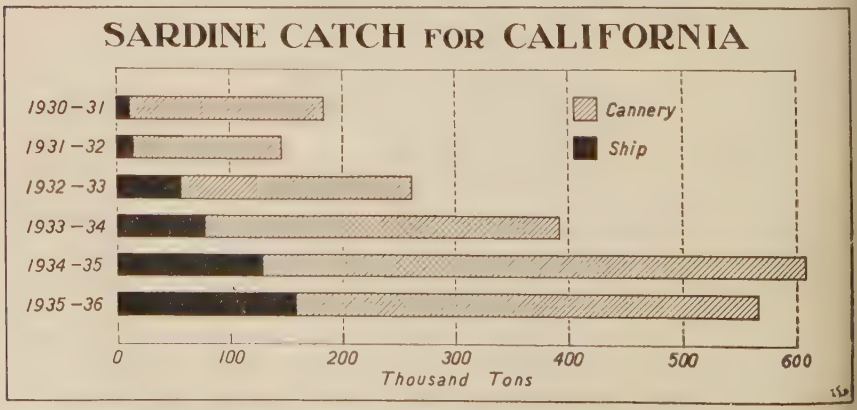

FIG. 5. The last six fishing seasons showing the sardines delivered to shore canneries contrasted with the increasing tonnage delivered to off-shore reduction ships.

canneries and off-shore ships. These figures do not include the large numbers of sardines caught in southern California to be used as bait for catching larger fishes nor do they include the sardines landed in Oregon and British Columbia. They merely tell what the canneries and floating reduction plants of this state received. Even though we see the figures we can not get the picture, it is too large but like all fishermen we modestly admit that we caught a lot of fish, about 4,092,700,000, in fact, but the season before last we caught many more than that (310 million more than that).

Aside from this spectacular growth to almost unbelievable size, our sardine fishery is a dramatic one. These fish are most easily located by the luminescence in the water, resulting from movements of the fish, so that nearly all the fishing for them is done on dark nights when the moon is not shining. The boats cruise with lights out and the captain watches in the water for the cloud of silvery light that means a school of sardines. When the circle net is cast, it becomes a cauldron of white light as the fish mill about seeking escape and the fishermen and visiting land-lubber are treated to a weird and impressive spectacle that is remembered afterward like a dream about something that couldn't have happened.

In passing, it might be mentioned that this trim, stream-lined fish, small in size, gigantic in numbers, is called a sardine because it truly is a sardine. Some people complain that it is not like the Maine sardine of our Atlantic coast and these people are correct but the complaint is wrong. The reason our sardine does not look like the one from Maine is that the one from Maine is not a sardine, so the complaint should be that the herring from Maine does not resemble our Pacific coast sardine. And still in passing, we should mention that our sardine is one of the best of our food fishes. The oil that makes the sardine so attractive to dealers in animal oils is responsible also for the high food value and fine flavor when this fish is canned or eaten as a pan fish. Sardines, when fresh, are a real treat, broiled over a bed of coals or fried in the pan.

Although sardines may be found along the entire coast line of California at some season of the year, the catch is made in four general fishing areas and deliveries are made to four marketing cities—San Diego, Los Angeles Harbor, Monterey, and the San Francisco Bay area. (See Fig. 6.) The recent increase in the San Francisco landings is a feature of this rapidly changing fishery, but Monterey still holds the lead as a sardine center with Los Angeles Harbor a close second. In central California the sardine run is earlier than it is in the southern part of the state and this fact was considered when the legal canning season was established. For Monterey and northward the canning season allowed by law is August 1 to February 15 of the following calendar year. South of Monterey the season is from November 1 to March 31 of the year following. This explains why we find the sardine catch expressed in two different ways, usually as a total for the calendar year but sometimes by a separation into the natural fishing season, involving parts of two calendar years. Business houses usually deal in a year made up of twelve months by the calendar, whereas fishermen do their figuring by fishing seasons and "darks." As catches are made on the nights when the moon is not in the sky, there is a sus-

pension of fishing during the few nights of the full moon, and this dark of the moon between one full moon and the next is locally called a "dark." This is not even an orthodox lunar month which is usually considered to be from one new moon to the next instead of from full moon to full moon. However, the fact remains that the sardine catch is no respecter of calendars but instead is the result of several "darks" making up a "season." To be impartial, we include tables to show the catches both by seasons and calendar years but until the moon can be induced to conform to the calendar, we spare you sardine catch data compiled by "darks" rather than by old-fashioned months.

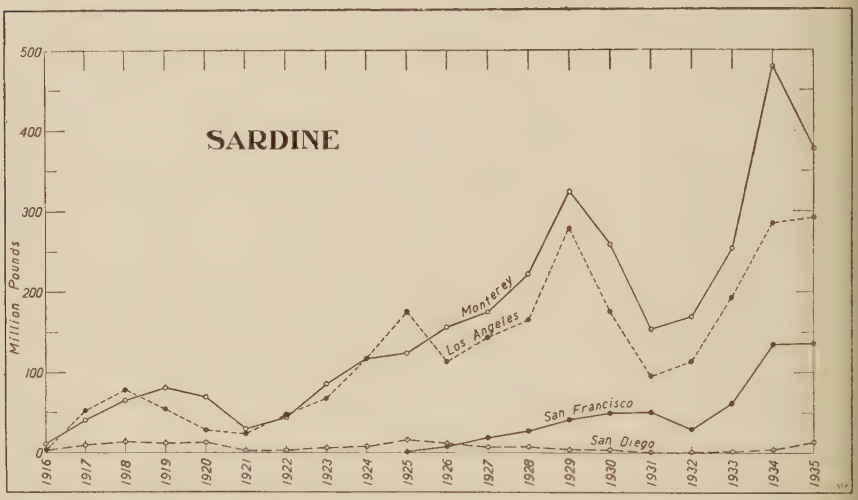

FIG. 6. The sardine catch by calendar years at the four principal ports of landing in California.

TABLE 1.

Sardines Landed in California by Calendar Years and Fishing Seasons.

Calendar years	*Tons*	*Fishing seasons*	*Tons*
1916	7,820	1916–17	29,430
1917	52,050	1917–18	74,610
1918	78,830	1918–19	73,210
1919	76,940	1919–20	69,570
1920	59,260	1920–21	40,930
1921	29,670	1921–22	38,410
1922	46,700	1922–23	65,160
1923	79,080	1923–24	84,090
1924	121,340	1924–25	172,860
1925	**157,650**	**1925–26**	**137,690**
1926	143,370	1926–27	147,700
1927	171,140	1927–28	182,870
1928	210,130	1928–29	254,450
1929	325,890	1929–30	324,240
1930	247,220	1930–31	173,820
1931	150,650	1931–32	133,440
1932	156,090	1932–33	205,530
1933	254,900	1933–34	315,480
1934	451,820	1934–35	483,360
1935	414,760	1935–36	409,680
Total	3,235,310	Total	3,416,530

TABLE 2.

Sardines Landed in Four Areas of California
In Tons.

Area	*1933–34*	*1934–35*	*1935–36*
San Francisco	36,358	68,810	76,155
Monterey	152,484	230,868	184,475
Los Angeles	125,048	178,818	138,400
San Diego	1,590	4,864	10,650
Total tons	315,480	483,360	409,680

TABLE 3.

Cannery and Reduction Ship Catch of Sardines
in California for Last Six Seasons.

Season	*Cannery and market catch*	*Reduction ship catch*	*Total tons*
1930–31	173,820	10,200	184,020
1931–32	133,440	14,100	147,540
1932–33	205,530	55,890	261,420
1933–34	315,480	77,130	392,610
1934–35	483,360	128,190	611,550
1935–36	409,680	158,750	568,430
Totals	**1,721,310**	**444,260**	**2,165,570**

TABLE 4.

Percentage of the Sardine Catch of California Taken by Canneries and by Off-shore Reduction Ships.

	Cannery	*Ship*
1930–31	95%	5%
1931–32	90	10
1932–33	79	21
1933–34	80	20
1934–35	79	21
1935–36	72	28

Most of our sardine tables are compiled to show the catch landed in the state at canning plants and at fresh fish markets so that unless otherwise stated they do not include the deliveries made off shore to reduction ships. These off-shore deliveries are shown in special tables. Nor do our tables include the bait catches of sardines made in southern California for use by sport and commercial fishermen. The catch delivered to packing plants and to fish markets is usually referred to as the cannery catch, because the amounts of sardines sold to fresh fish markets are so small that they comprise but a fraction of one per cent and may be disregarded for all practical purposes. In some of the following tables, the contrast between cannery catch and off-shore or reduction ship deliveries is shown both by tonnage and as percentage of the total combined catch.—*W. L. Scofield.*

References (see page 164): 26, 104.

ANCHOVY

The anchovy is an important article of diet for practically all predacious fish and as such it makes excellent bait. It is as bait that most of the anchovies caught in California waters are used.

In 1935 about 84 per cent of the commercial landings were divided almost equally between the San Francisco and Monterey regions, with

Los Angeles taking the remaining 16 per cent. However, the figures on the commercial landings show only what was actually brought ashore and sold. In the case of the anchovy by far the greatest part of the fish caught are used as live bait, are never brought ashore and hence never get into our records. This is particularly true in the Los Angeles region where over one hundred boats fill up their live bait tanks almost

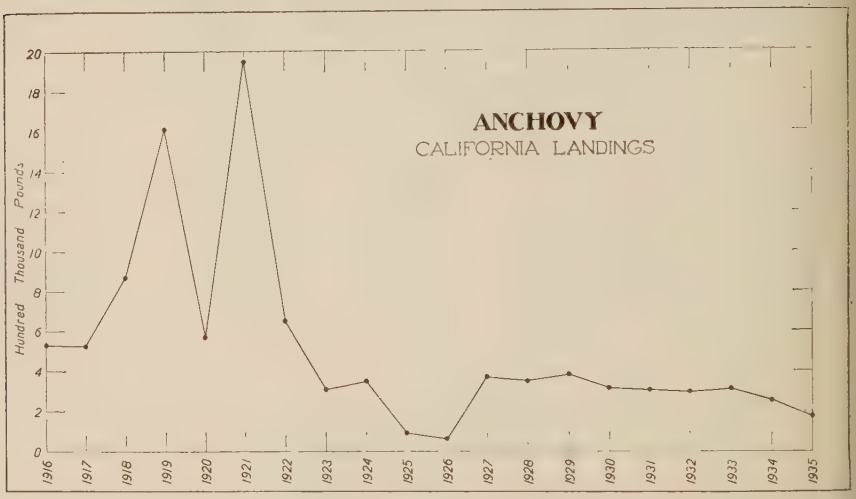

FIG. 7.

every day for eight months of the year. It seems probable that the actual yearly catches of anchovies may run as high as ten million pounds with the Los Angeles region taking by far the largest part. A ten-million pound catch would be over fifty times as large as the 179,000 pounds shown on the records for 1935.

At San Diego comparatively few anchovies are used. There are many live bait boats in the region, but there are also plenty of small sardines, which, for the type of fishing done in that region, are by far the best bait obtainable. At Los Angeles sardines are not always obtainable.

The three species comprising the anchovy landings in California are *Engraulis mordax, Anchoviella compressa,* and *Anchoviella delicatissima.—Donald H. Fry, Jr.*

HERRING

Important as it is elsewhere in the world—in the North and Baltic seas, on the Atlantic coast, and in Alaska—in California the herring fishery has never been extensively developed. The Pacific herring (*Clupea pallasii*), which is closely related to the Atlantic species, is distributed along the coast of North America from San Diego Bay to the Aleutian Islands and thence south along the shores of Siberia and Japan. Largest amounts are taken in Alaska where the herring ranks second to the salmon in amount landed.

In California most of the herring are taken in gill nets or beach seines during the period from November to April when the fish enter

ıe bays in large schools to spawn. Largest quantities are caught in omales and San Francisco bays, smaller amounts are taken in Humoldt, Monterey and San Diego bays, and occasional catches are eported made by lampara boats fishing off shore for sardines. Although iis species was not believed to occur as far south as Mexico, the 1934 nportations of fish from that country included 2750 pounds of herıng. At San Pedro the queenfish, a member of the croaker family, oes by the name of herring and it is possible that the Mexican fish was iis species.

Most of the herring caught in California at the present time are sold ı the fresh fish markets at a price remarkably low for fish of their ood flavor and high food value. Some are sold for bait and some are ured at Tomales Bay by the Scotch method, that is, graded according o size, salted lightly, and packed in barrels. In 1935 almost one-tenth f the catch was preserved in this manner.

In the twenty years covered by our record, the yearly landings reach heir highest points in 1916, 1917, 1918 and 1919. During these years ıuch herring was used for reduction purposes, and the war-time emand for fish as a meat substitute was making itself felt in greater resh fish consumption as well. Considerable quantities of herring aught at Tomales Bay and canned at Pittsburg in 1917, 1918 and 919 further boosted the landings for these three years. The state eduction act,* which went into effect in July, 1919, and the discontinunce of canning operations after that same year combined to bring the 920 landings down to the lowest level recorded. From 1920 to 1935 slight upward trend is apparent although the heights of the war

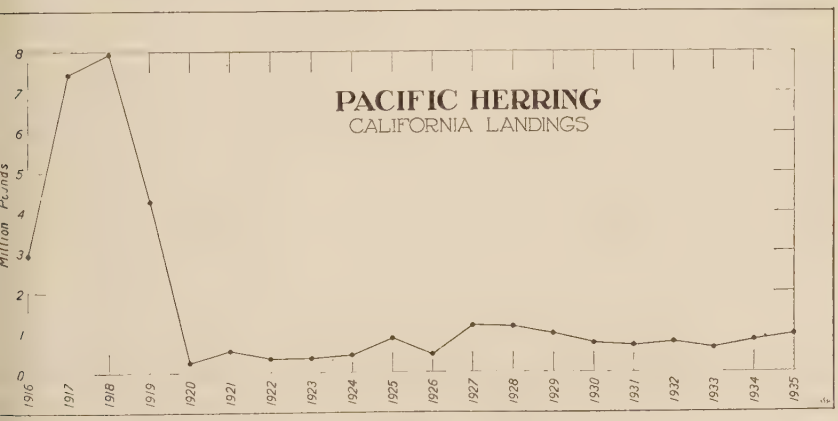

Fig. 8.

eriod have never since been approached. In the past the demand for erring has seemed to be the most important factor in the determinaion of the size of the catch. Apparently the supply has never been vertaxed, and should the demand increase sufficiently in the future o induce fishermen to use larger boats and nets in capturing these

* This act prohibits the use of fish for reduction purposes without written permision from the Division of Fish and Game.

fish before they come into the bays to spawn, it is believed a good-sized industry could be developed.—*Dorothy Wilson.*

References (see page 164): 79, 82, 84, 93.

PACIFIC MACKEREL

This fish (*Pneumatophorus diego*) is a true mackerel, closely related to the Atlantic mackerel (*Scomber scomber*) and even more closely to the chub mackerel (*Pneumatophorus grex*) of our Atlantic coast. The commercial range is from San Francisco to Ensenada, Lower California.

The history of the development of the mackerel industry has been covered in great detail in several previous publications of the Division of Fish and Game and can be dismissed with a brief summary. Previous to 1928 nearly all the mackerel was taken with hook and line and sold to the fresh fish markets at Los Angeles, Monterey or San Diego.

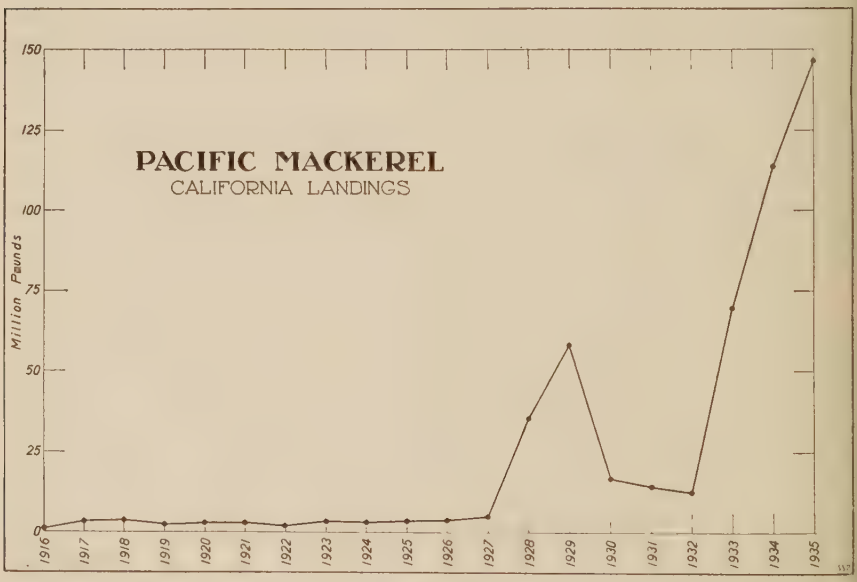

FIG. 9.

A very little was smoked, salted or experimentally canned. By the latter part of 1927 one cannery had developed a satisfactory method of canning mackerel, and during 1928 and 1929 most of the fish canners in southern California went into the new business—some of them with more enthusiasm than judgment. Due to a combination of circumstances (including many poorly packed mackerel and the national depression) the new industry had three bad years in 1930, 1931 and 1932. Then, having learned a few things about how *not* to pack mackerel, the canners got off to a fresh start and have done very well from 1933 up to the present (June, 1936). The effect which canning had on the catch can be seen in figure 9 and by comparing the years before and after 1927.

The great increase in the catch in 1928 was *not* brought about by changes in the existing fishery—the hook and line fishery for the mar-

kets did not undergo any great change and has not altered to any extent up to the present time. The increased demand was met by an entirely different fleet of boats, the great majority of which fished with ring nets or purse seines and fished only for the canneries. The two fisheries have gone on side by side without either having had any great effect on the other. The hook and line boats could not meet the cannery demands of great quantity and low price and the net boats could not handle the fish carefully enough to suit the fresh fish markets.

Most of the mackerel delivered to the fresh fish markets are taken by boats which fish for little else. These are 25 to 35 foot jig boats operated by one or two men. They all fish within a few miles of the home port. At Los Angeles and San Diego these boats operate with set lines of several hundred hooks each. Each boat will carry four or five of these lines, but if fish are abundant not more than two may be used. At Monterey the gear is far simpler. A short hand line, two to seven fathoms long, is weighted with a very small piece of lead and equipped with one or more hooks. Each boat uses several such lines. As soon as the fish bites on this gear, it is pulled aboard.

Most of the cannery mackerel are taken by purse seine and ring net boats, which are 45 to 75 feet long and have a crew of 10 or 12 men. These boats usually fish within a few miles of port. At Los Angeles, where the industry is best developed, the boats will sometimes go as far as 80 miles from port; however, this is seldom necessary. At San Diego and Monterey the boats will not go a quarter this distance, if they can not find fish closer they simply report "no fish" and let it go at that.

The most common way the seines are used is as follows:

The crew attracts mackerel around the boat by throwing ground-up fish (chum) overboard. When a school gathers, the boat moves away slowly, leaving a man in the skiff to hold the school in place with more chum while the boat sets its net around fish, skiff and all.

In the Los Angeles region there is a period in the late spring and early summer when the fish are more particular about what they eat and can not readily be attracted by ground chum. During this time, small live bait boats will chum up a school of mackerel by using live anchovies and sardines in place of ground fish. A net boat then sets its net around the bait boat and the two then split the catch, two-thirds to the net boat and one-third to the bait boat.

There are periods when most of the mackerel fishing is done at night. In the ocean phosphorescence outlines any moving object and on moonless nights, schools of fish are very conspicuous. Experienced fishermen usually have no trouble distinguishing the kind they are after. As a rule no chumming is done at night; the men simply set their net around a school and haul it in.

Part of the cannery catch in the Los Angeles region is taken by "striker" boats, which are small live bait boats that chum up a school of mackerel using either ground chum or live bait or a combination of the two. When the fish are in such a frenzy of excitement that they will snap at anything, the "strikers" are brought into play. These are feathers mounted on a barbless hook. They are skittered around on the surface. A fish strikes, the fisherman flips, the fish sails aboard and usually spits the hook out while it is still in the air. The fisherman

then snaps the striker back into the water for the next customer. When this method is working properly, it simply rains fish. Another piece of equipment is brought into play when most of the large fish near the boat have been caught and few remain except those which are too small to take the striker properly. This is a large dip net made of chicken wire. The fish are so excited that they pay little attention to anything except the chum and can be dipped up a dozen or two at a time.

The relative importance of the mackerel fishery in the various regions of the State during 1935 can be seen in figure 10. Los Angeles is way in the lead because there are several large canneries in that region which make mackerel packing a very serious business, and because there are many fishermen who make a large part of their yearly income fishing mackerel for the canneries. These men know the business from A to Z and work hard at it. At San Diego mackerel canning is not taken as seriously by either the canners or the fishermen and in addition there are fewer canneries. At Monterey the canning is hardly past the experimental stage. There are many sardine canneries in the region, which with comparatively few additions could handle huge ton-

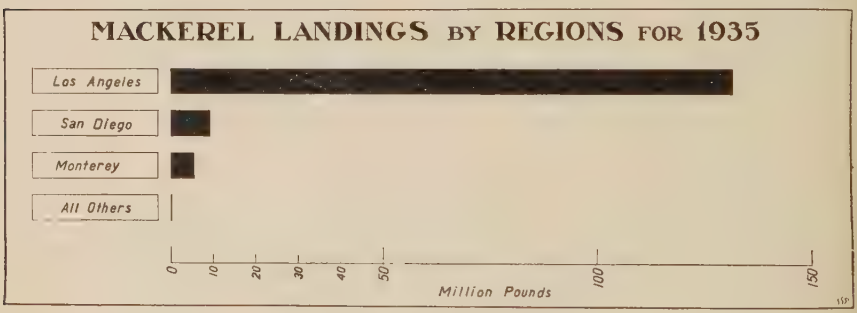

FIG. 10.

nages of mackerel—if they could get the fish. It may well be that mackerel are actually much less abundant there than farther south, but there is also the possibility that a few expert cannery mackerel fishermen could get a great deal more than is now being taken.

The fresh fish market landings of mackerel are greatest at Los Angeles. Monterey supplies the San Francisco markets with mackerel and hence ranks second in this field. San Diego, with less demand due to a much smaller population, is third.

Figure 11 shows the mackerel seasons at Los Angeles, San Diego and Monterey.

At Los Angeles the seasonal chart probably comes fairly close to showing the relative abundance throughout the year, as there has been a demand for cannery mackerel during all months. There is a very definite period of scarcity which is worse in April. This usually ends some time in May and fishing starts with a rush. There may or may not be a short period of comparative scarcity during the late summer. This has never been serious. Fishing is best during the fall and is good well into December. The fish may disappear in late December or may remain as late as March. When the period of scarcity does come

it causes a complete suspension of canning activity. The set liners, who fish for the markets, are usually able to get all the mackerel they need at all times of the year.

At San Diego the seasonal curve is somewhat similar to the one at Los Angeles, but is more influenced by economic conditions and hence

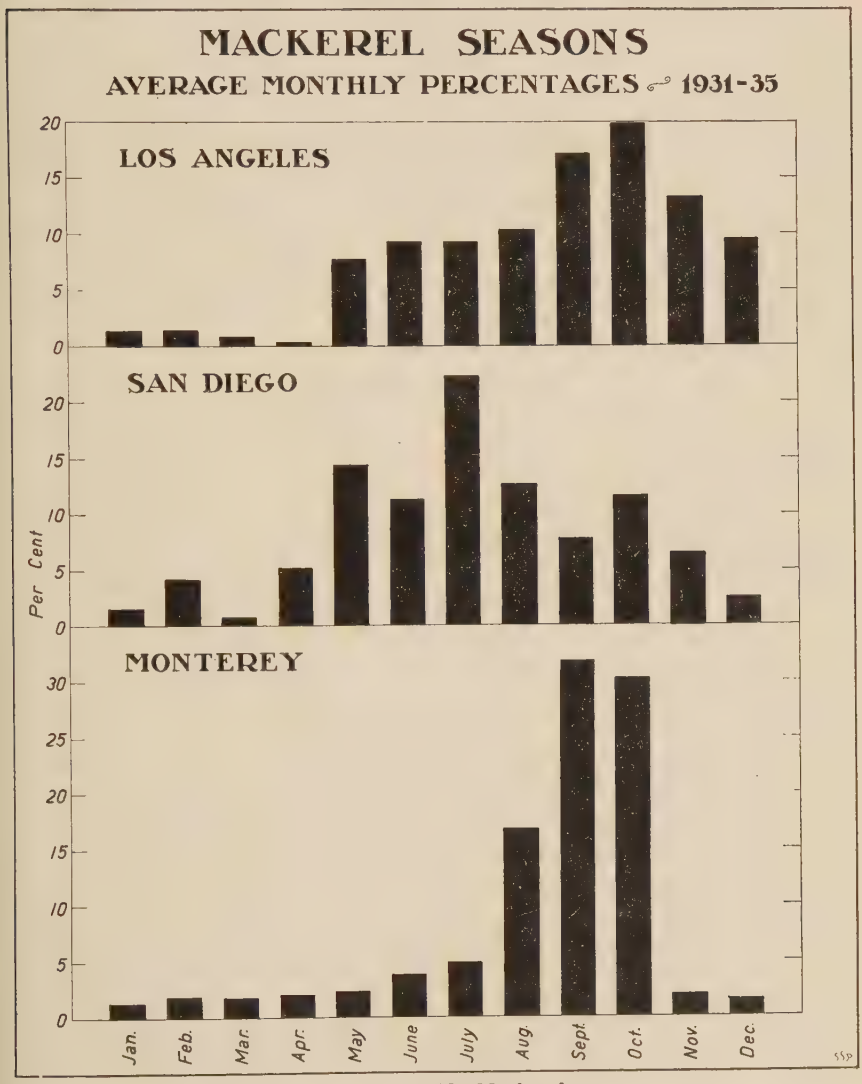

FIG. 11. Pacific Mackerel.

does not reflect actual abundance as well. There is a period of scarcity similar to the one at Los Angeles but March is the low month instead of April. The erratic behavior of the curve through the summer and fall is due to a lack of steady demand at the canneries and to a tendency on the part of the fishermen to desert the mackerel whenever higher priced fish appear in numbers.

At Monterey the cannery boats have been able to get fish in quantity in August, September and October. There definitely is a period of scarcity at Monterey, but what its limits are will not be evident until there has been more effort to get fish in quantity throughout the entire year.

The mackerel is a peculiar fish as far as edibility is concerned. It can be one of the best of food dishes—or one of the worst—depending largely on the treatment it receives. When packed "tuna style" it closely resembles the finest tuna in appearance and flavor. However, over 99 per cent of the pack is "salmon style." In this condition it competes with the cheaper grades of salmon and resembles salmon somewhat in flavor, less so in appearance. Even in putting up the cheap salmon style pack, a little judgment and care will make all the difference between a product which a housewife will buy again and again, and one which she will open once—and feed to the cat. The canneries learned this through bitter experience—let us hope they can remember it.—*Donald H. Fry, Jr.*

References (see page 164) : 51, 57, 58.

HORSE MACKEREL

The horse mackerel is a member of the yellowtail family, usually weighing less than two pounds. Its commercial range is from Monterey to San Diego.

This species, though not at all closely related to the Pacific mackerel (*Pneumatophorus diego*), is quite similar to it in size, general appearance and habits. As a result the two were so confused with each other in the catch records that they were grouped together until 1926. Of the two the Pacific mackerel is by far the more important species.

There is no special fishery for horse mackerel, they are caught incidentally by boats fishing for the Pacific mackerel. Most of the horse mackerel taken are mixed with the other species, though it is not at all uncommon for a boat to find an unmixed school. The fish are taken with ring nets and purse seines by boats fishing for the canneries and with set lines by the fresh fish market boats.

At the fresh fish markets horse mackerel are well regarded and often bring a better price than mackerel. At the canneries this does not hold true. The Pacific mackerel makes a better pack and hence brings a better price. In 1935 the cannery prices for the two species were $15 and $6 per ton, respectively. The result of this peculiar situation is that when a cannery boat brings in a load containing any great quantity of horse mackerel it will often go first to the fresh fish markets and sell what it can. The markets will seldom accept net-caught mackerel, as the rough handling usually bruises them enough so that they will not keep well. Horse mackerel withstand the bruising much better and are perfectly acceptable.

The rise in the horse mackerel catch in 1933, 1934 and 1935 was due primarily to the heavy mackerel canning which has been going on in the Los Angeles region. In 1935 there was a particularly great rise because for a period of months there was very heavy mackerel fishing going on around the Channel Islands. Horse mackerel are much more abundant in those waters than along the mainland shore, and as a result many more of them were taken by the mackerel boats.

During 1935 the horse mackerel (*Trachurus symmetricus*) landings in the various regions were:

Los Angeles	9,835,806 lbs.
Monterey	146,424 lbs.
San Diego	1,454 lbs.
Santa Barbara	240 lbs.

The 1935 landings at Los Angeles are several times that of any previous year, for the reason mentioned above.

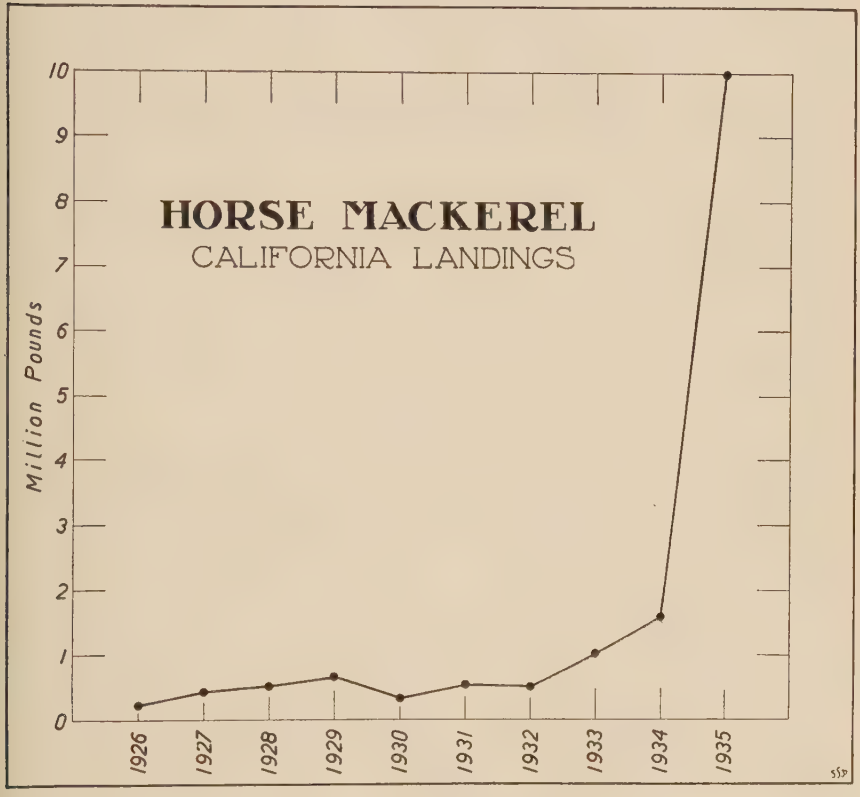

FIG. 12.

At Monterey the horse mackerel landings were about normal, even though canning activities brought the Pacific mackerel catch far above normal.

No great quantities of horse mackerel are ever landed at San Diego or Santa Barbara.—*Donald H. Fry, Jr.*

Reference (see page 164): 51.

SPANISH MACKEREL

The Spanish mackerel (*Scomberomorus sierra*) is a long slender member of the mackerel family, averaging three to five pounds in weight. All those landed in California are caught along the Lower California coast.

The catch of this species is not at all limited by the supply. The fish are abundant enough to yield a catch many times the size of the present one.

Although the Spanish mackerel is an excellent food fish it is not well known in California, consequently the demand for it is very limited. As a result the boats bring up only a few, taken incidentally with other kinds of fish.

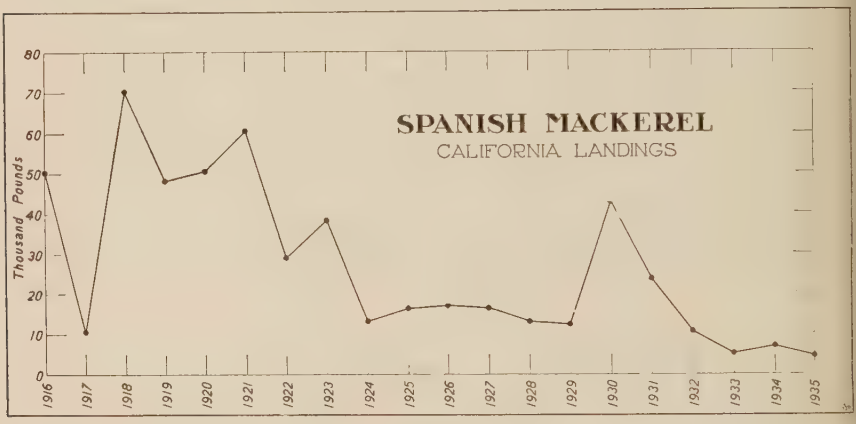

FIG. 13.

It seems probable that the sale of Spanish mackerel has been limited by the custom among market men of calling another unrelated species by the same name. That species (the horse mackerel) is a member of the yellowtail family, and is what a retail fish market or restaurant owner would get if he were to telephone a wholesaler and ask for "Spanish mackerel."

The yearly fluctuations in the catch look quite violent, but do not seem at all important when it is realized that the three largest years' catches combined would not make one full load for a large fishing boat. The fluctuations simply reflect the luck that a few fishermen had in disposing of what they did happen to bring to market.—*Donald H. Fry, Jr.*

Reference (see page 164): 51.

THE FIVE TUNAS

The tuna industry of California utilizes five local species of the mackerel family, and in addition imports from Japan and Hawaii small quantities of frozen tuna which are packed in local plants. Whereas differences in color and quality exist between these several species, all are handled and packed in the same manner and sold in a market, though under different names, which has been expressly developed for the tuna pack. The growth and trend of the industry are therefore best revealed by the annual landings of tuna, all of which (except negligible quantities marketed fresh) are absorbed by the canning industry. Figure 14 shows graphically the total annual landings and importations of all tuna and tuna-like fish in California, embracing yellowfin tuna, bluefin tuna, skipjack, albacore and bonito from local and adjacent

waters; and yellowfin tuna, oriental tuna, albacore and skipjack imported frozen from Japan and Hawaii. Included also is a relatively small tonnage of unclassified tuna. The figure shows clearly the growth of the industry. From 1925 to the present the catch has doubled, and this increase is essentially due to the development of the yellowfin tuna and skipjack fisheries.

Yellowfin Tuna and Skipjack

With increased demand it became imperative to secure greater catches. Whereas the run of albacore and bluefin tuna are seasonal and erratic, yellowfin tuna and skipjack may be taken throughout the year somewhere within the area delimited by southern California to the north and south of the equator. A logical consequence of this was that larger vessels were built and the season gradually extended until it now embraces every month of the year. The change is strikingly shown by plotting the catch of the three months, August, September and October, representing the season of earlier years as a percentage of the total annual combined catch of skipjack and yellowfin tuna. (See Fig. 15.) The decreasing importance of the earlier season is

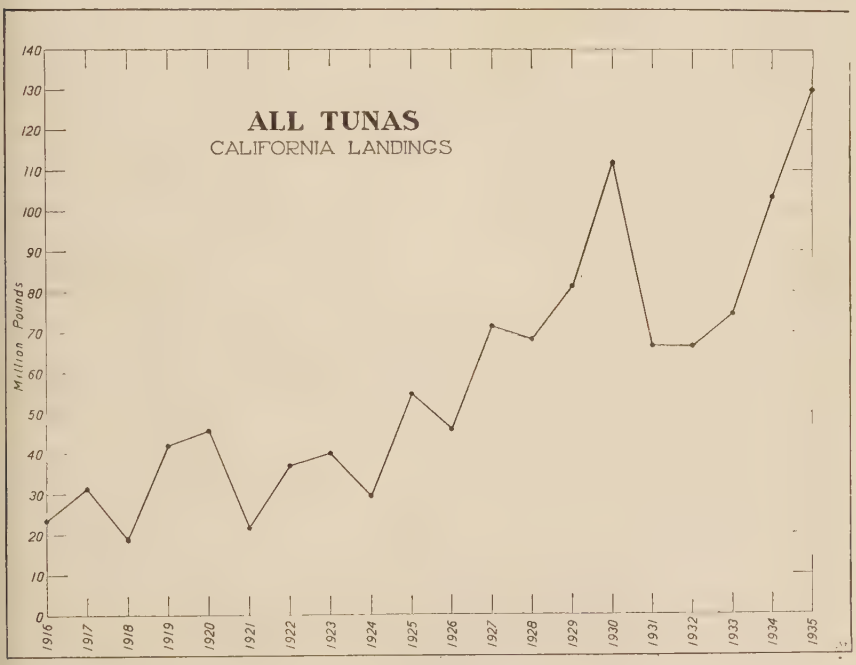

FIG. 14.

essentially due to the construction of increasingly larger vessels which were able to extend the fishing range and thus prolong the season. The tuna boat of today is a vessel approximating 130 feet in length and costs as many thousands of dollars.

The catches of yellowfin tuna and skipjack are shown in Fig. 16. Together they reveal an interesting story. The relative stability of the industry to 1924 is apparent in both. In 1925 a number of new and

larger vessels augmented the fleet, and the increased catch is reflected in both figures. These vessels, though larger, were essentially similar to the older ones and still depended exclusively upon ice as a refrigerant. The length of trip and the fishing range were therefore not materially affected. As a consequence the proportion of the two species—skipjack and yellowfin tuna—remained the same, both showing a steady increase up to 1927. That year marked an epoch in the tuna fishery. Two boats were built or being built, of 100 or more feet over all, and both were equipped with refrigeration consisting of an ammonia compressor and coils in the hold. This departure enabled the boats to conserve their ice, stay out longer and extend their fishing range. On these longer trips, it was subsequently discovered that the skipjack did not possess the keeping qualities of yellowfin tuna, and much of the skipjack landed was condemned upon delivery at the canneries. Also, the

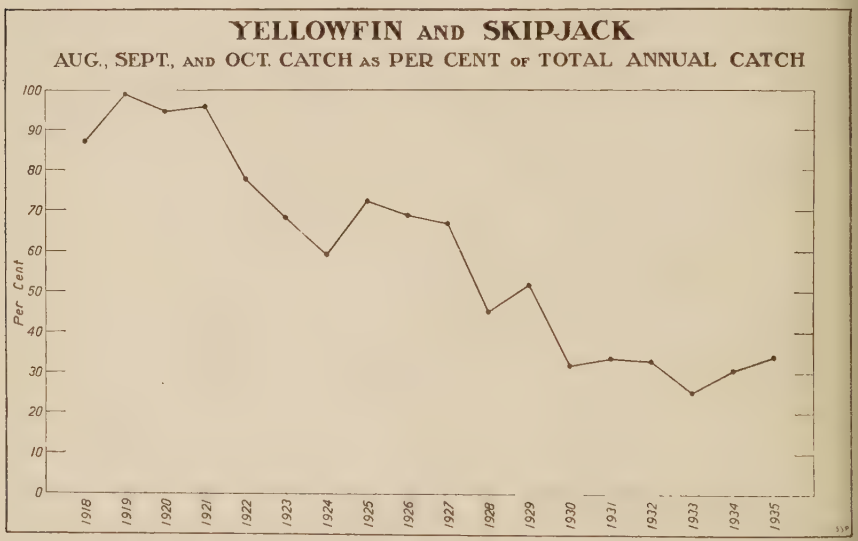

FIG. 15.

yellowfin commanded a higher price. Hence the fleet of larger vessels which slipped from the ways in rapid succession in the ensuing years, strove to load exclusively with yellowfin tuna on the longer trips to distant fishing grounds; and this explains the change in trends in figure 16. Yellowfin tuna is now the mainstay of the fishery, whereas skipjack plays a minor though important role.

The two fisheries are essentially a unit and must be considered as a single fishery. Both species are caught by the same fleet at the same time in the same areas—in fact the two species often intermingle in a single school. Hence the catch of skipjack and yellowfin tuna should be combined to obtain the trend of this fishery. This has been done in figure 17, and superimposed for comparison upon this graph is the catch of all tunas shown as in figure 14. It is apparent from this that the history of the tuna industry has become in fact the story of the combined fishery for yellowfin and skipjack. In the past five years the catch of yellowfin and skipjack by our local fleet has contributed prac-

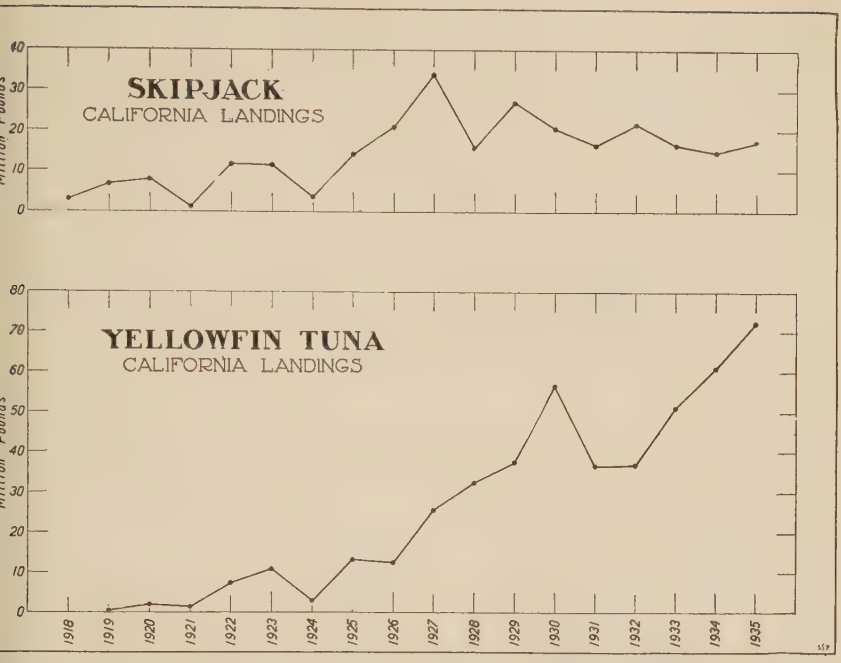

FIG. 16. Upper graph represents landings of the California commercial fishing fleet and does not include frozen skipjack from Japan and Hawaii.

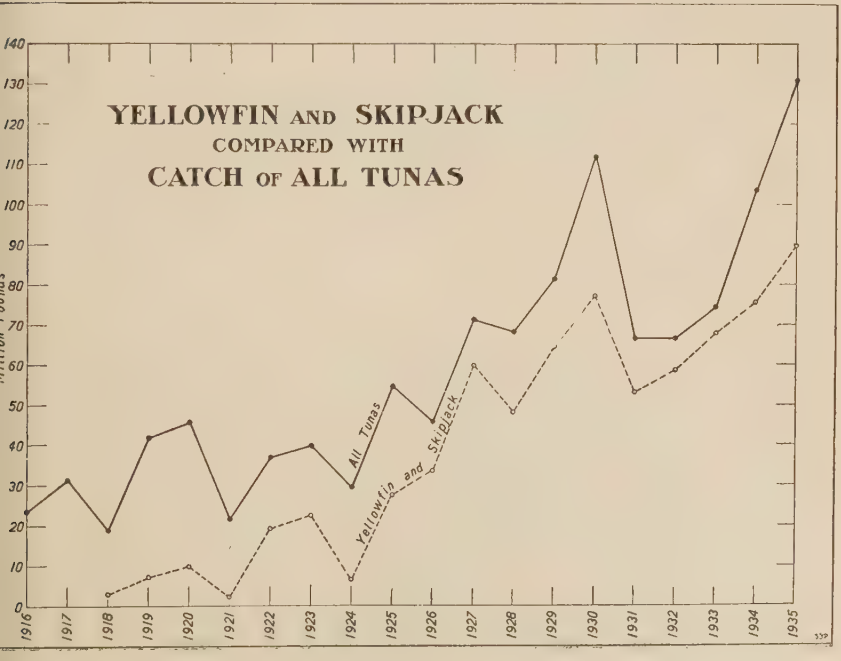

FIG. 17.

tically 78 per cent of the entire catch and total importations of all the tunas. The trend of the industry is therefore revealed by the trend of this fishery and this is shown in figure 18. Here the combined catch of yellowfin tuna and skipjack is reproduced. Discounting the yearly fluctuation the steady growth of the industry is more apparent.

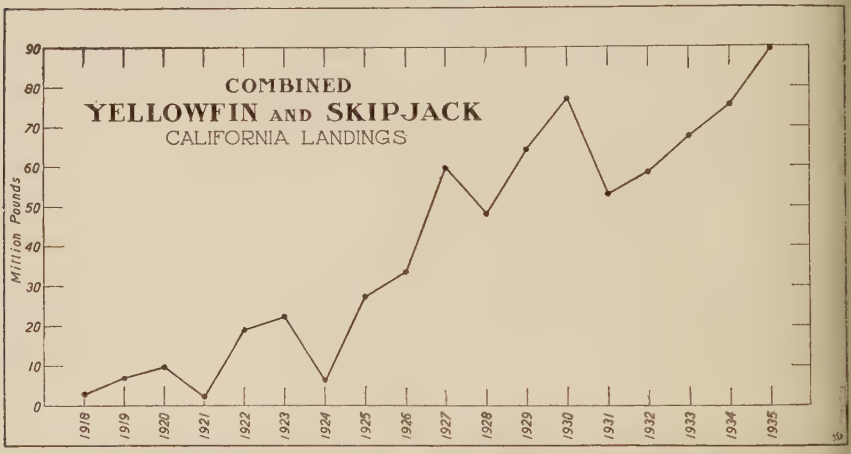

FIG. 18. Graph represents landings of the California commercial fishing fleet and does not include frozen tuna from Japan and Hawaii.

With the growth of the industry, increasing quantities of yellowfin tuna and skipjack were taken in territorial waters of foreign countries, and in recent years the entire catch has come therefrom or from the waters adjacent. Naturally such countries have become interested in the matter, and innumerable inquiries are now addressed to our laboratory concerning the proportion of the catch taken in the waters of each country. We are attempting gradually to acquire this information, but as yet our records are far from complete. Such information as we have is obtained in confidence from boat captains for the furtherance of our studies. Moreover, it is inadequate to warrant any general summaries. For these reasons discussion of this topic must be postponed to a future date.

Bluefin Tuna

Next in importance is the fishery for bluefin tuna. As stated above this is a seasonal and erratic fishery. The bluefin catch is made entirely by circle nets, by far the largest portion being taken with purse seines. The season extends from about June to September, though irregular catches are occasionally made both earlier and later. The early catches are invariably made in the vicinity of Guadalupe Island about 200 miles off the coast of Lower California. As the season advances, fish appear off the coast of southern California and around the adjacent islands. No catches are made north of Point Conception, though there is accumulating evidence to show that fish occur northward late in the fishing season. Nothing is known concerning the biology of this tuna.

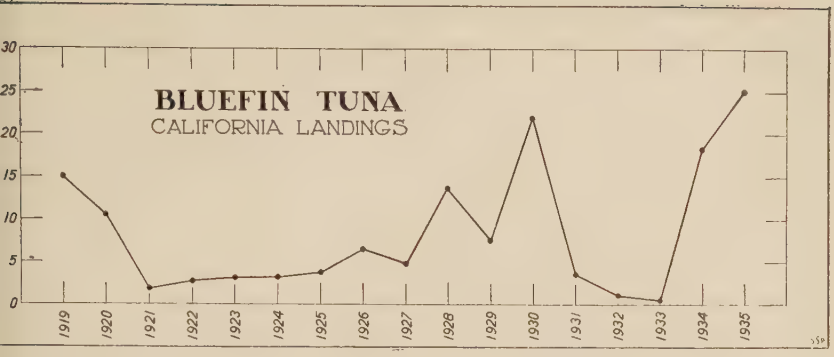

Fig. 19.

The catch of bluefin tuna is portrayed in figure 19. With the cts available, the catch is not amenable to a detailed analysis. hough economic conditions certainly affect the catch, the major ıctuations shown in figure 19, are primarily biological, and due to ailability of fish within our fishing area. The price paid to the shermen for bluefin tuna is usually $10 per ton less than that paid r yellowfin, but the price does not necessarily reflect the condition the market. Thus in one year the fishermen received a normal rice for a large catch of bluefin, at a time when warehouses were full ıd the market for canned tuna was decidedly weak. Business rivalry nong the numerous packers may explain occasionally some of the nomalies of the catch. The low catch of some recent years may be tributed in part to the effect of Mexican taxation and restrictions. t times when such restrictions were operative, the catch of bluefin off ıe Mexican island of Guadalupe was seriously curtailed. A detailed ıalysis of these factors is beyond the scope of this brief article and ould moreover in no way invalidate the statement that the major ıctuations in the catch are due primarily to the availability of fish ithin our fishing area.

Albacore

Up to 1925 the albacore contributed the major portion to the ına catch. Since then it has declined to very minor importance and the last ten years the catch has been almost nothing. Since the ıception of our statistical records in 1916, the trend of the catch has een steadily downwards. (See Fig. 20.) No adequate explanation this fact is possible. Depletion has been suggested, but in view of ır ignorance of this fishery—the size of the stock, the range, migra- ons and habits of the species—it is futile to attempt to substantiate ıis.

The albacore is cosmopolitan in distribution and perhaps the ost truly oceanic of all the tunas, so that it is quite possible that the regularity of our local runs may be associated with oceanic environ- ental factors.

The place of the albacore in the industry has been taken by yellow- n tuna, bluefin tuna and skipjack. The albacore however is the ıly tuna with "white meat," and because of this a small market xists for this product. With the failure of our supply in the last

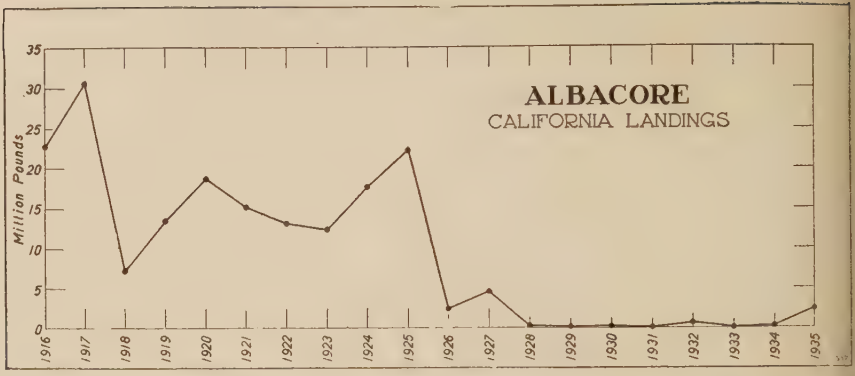

FIG. 20. Graph represents albacore landings of the California commercial fishing fleet and does not include importations of frozen albacore from Japan and Hawaii.

decade, small quantities of frozen albacore have been imported from Japan—and to a less extent from Hawaii—and canned locally to supply this demand. Between 1927 and the present, the annual importations have averaged around 2000 tons.

The albacore fishery is distinctly local. It centers off southern California, and the catch is delivered in the Los Angeles region or at San Diego. In occasional years small quantities are landed at Monterey, and there are substantiated reports of albacore in abundance farther northward. Despite the intensive fishery in the south, albacore have never been seen or taken much south of the United States-Mexican boundary. In our records small tonnages appear as imports from Mexican waters, but all this fish is taken by local San Diego boats in the vicinity of the Coronado Islands, just below the international line. The albacore season extends roughly from June to October, with straggling catches later in the fall. At Monterey the fish, when they occur, are taken in September and October. The entire catch is taken with hook and line, partly with live bait and in part by trolling. Netting has never been successfully employed for albacore.

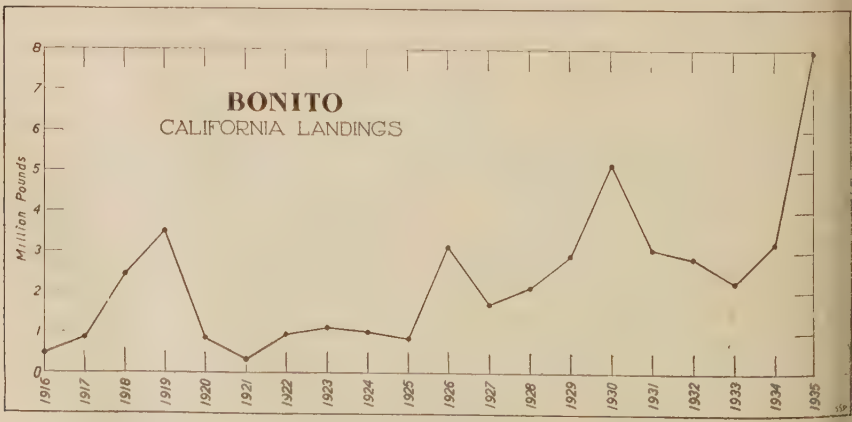

FIG. 21.

Bonito

The catch of bonito is the least important of all the so-called unas. In fact the total landings of bonito from 1916 to 1935, nclusive, amounts to only 46,838,271 pounds, which is slightly more han half the tonnage of yellowfin tuna landed in 1935 alone. The andings in individual years are shown in figure 21. The fishery hows a slight upward trend though considerable fluctuations exist rom year to year.

The bonito is a fish closely related to the tunas and is packed 'tuna style.'' In the market, however, it is sold as bonito and not tuna. t does not strictly compete with tuna but sells in a lower price group. The periodical high catches of bonito may possibly be associated with periods of increased demand for cheaper canned fish. Whether this s strictly true or not, it is a fact that the industry accepts all the bonito available when the demand for the cheaper grades of tuna is good, whereas at times when sales of such are slack, no effort is made by the canneries to obtain bonito.

The bonito under discussion is a fish of more restricted distribu- ion than most tunas. It is abundant seasonally from Pt. Conception, California, to Cape San Lucas or thereabouts in Lower California. In outhern California it is taken in abundance in the late summer and the all, whereas in Lower California it appears to be abundant throughout he year. Apparently it is confined to the coastal shelf. It is taken both with circle nets and hook and line. It is perhaps safe to say that bonito as a rule is taken only incidentally. Occasionally and in certain easons it may be sought expressly. The purse seiners fishing bluefin una sometimes deliver loads of bonito when bluefin are scarce. The mackerel boats will take bonito whenever they are encountered. The maller tuna boats that fish the coast of Lower California will fill up with bonito to pay expenses when no tuna is available. Within its ange the bonito is abundant and the fishery seems capable of expan- ion. Its slow growth is probably due to economic rather than biologic actors. Thus, no great effort has been made to develop the market. The scale of Mexican taxation and duties has moreover inhibited the ishery below the international line. The price paid by the canneries s about 60 per cent that of yellowfin tuna and there have been times when the tariff was so high that it did not pay to fish bonito in Mexican waters. The tonnage taken therein and locally varies greatly from ear to year. In the interval from 1916 to 1935, both inclusive, the bonito caught in Mexican waters constituted 31.2 per cent of the entire catch. The percentages for individual years are given in figure 22.

Importations

With the expansion of the tuna markets, some of the smaller packers found it more economical to import frozen tuna from Japan and can it locally than to invest the large amounts necessary to finance he construction of a fleet of tuna vessels. And thus since 1930 small mounts of tuna, mostly *Thunnus orientalis* (the Oriental tuna) and kipjack, have arrived by freight from the Orient. Earlier than this, however, and coincident with the failure of the local runs of albacore, quantities of frozen albacore were imported from both Japan and Hawaii to supply the demand for ''white meat'' tuna. Such shipments

started in 1927 and have continued uninterruptedly to the present. As stated earlier the average annual importations of frozen albacore approximate 4,000,000 pounds. Importations of the various tunas from Hawaii and Japan are given below.

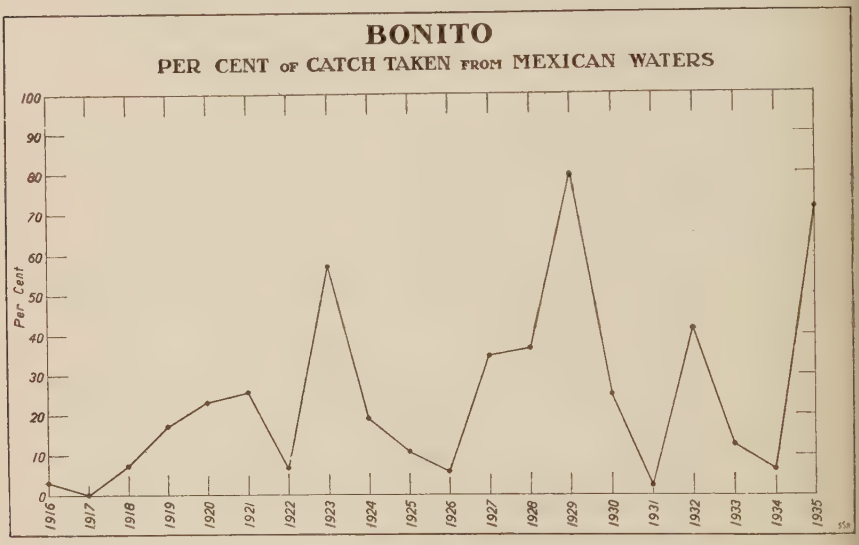

FIG. 22.

TUNA IMPORTATIONS FROM JAPAN AND HAWAII

	Albacore	Skipjack	Yellowfin tuna	Oriental tuna	Total pounds
Japan					
1928	3,724,955				3,724,955
1929	5,798,175				5,798,175
1930	7,000,142		3,587		7,003,729
1931	6,939,079		1,896		6,940,975
1932	2,368,801			1,053,795	3,422,596
1933	2,750,353	405,733		899,336	4,055,422
1934	4,090,291	1,579,245	223,942		5,893,478
1935	3,231,265	2,606,768		146,531	5,984,564
Hawaii					
1928	57,453				57,453
1929	43,054	59,575			102,629
1930	5,426				5,426
1932	98,720				98,720
1933	43,612				43,612
1934	25,900				25,900

Many of such shipments are consigned under the conventional Japanese name of the species, and the California State Fisheries Laboratory receives numerous inquiries concerning the identity of the fish. For the benefit of those interested, the vernacular Japanese names are here listed for each species. The authority throughout is Kishinouye (1923).

Yellowfin Tuna	*Skipjack*	*Oriental Tuna*	*Albacore*
Kihata, or Kiwada	Katsuwo	Kuroshibi	Tomboshibi
Gesunaga	Magatsuwo	Gotohshibi	Binchoh
Hashibi	Mandaragatsuwo	Maguro	Binnaga
Hatsu		Medi or meji (immature)	Kantaro
Hirenaga			
Itoshibi			
Kinhire			
Kimedi (immature)			

Unclassified

Until quite recently no staff member of this laboratory was assigned to the problems of the tunas. In the earlier statistical records occasional loads of tuna appear without specific identification. With the lapse of time since these deliveries, it becomes increasingly difficult to determine to what species these amounts belong. Pending a thorough analysis of this material it was decided to list it as "unclassified" rather than attempt an arbitrary segregation which would impair the accuracy of our statistics. As the matter stands, the records upon which this bulletin is based are accurate and err only by the omission in the specific discussions of the small amounts of tuna "unclassified". —Harry G. Godsil.

References (see page 164): 38, 40, 42, 44, 60, 65, 106.

YELLOWTAIL

The yellowtail is an excellent game fish, averaging perhaps 10 pounds in weight and occasionally reaching 30 pounds or more. Even from a financial point of view, it is probably a good deal more important as a game fish than as a food fish, but it is in this latter capacity that this article deals with yellowtail.

The commercial range of the yellowtail (*Seriola dorsalis*) is from Point Conception south to the tip of Lower California. In California these fish are taken in the spring, summer and early fall, whereas in Mexican waters they may be caught at any time of year.

At Los Angeles there is no real yellowtail fishery—several purse seine boats go looking for barracuda, one of them sights a school of yellowtail and gathers it in. A jig boat operator, trolling for baracuda, decides to take a few yellowtail and speeds up his boat. He does not have to change lures, a higher trolling speed is all that is necessary.

At San Diego there is a fleet of small live bait boats which take whatever chooses to bite a live sardine, but depend for most of their income on yellowtail and barracuda.

The boats which fish yellowtail in Mexican waters fall into two sharply divided groups—those which fish at the Coronado Islands and those which go farther south. The Coronado Islands are less than twenty miles from San Diego, and the fishing there is done by the same small live bait boats which fish California waters in that region.

The rest of the Mexican yellowtail comes from far south of the border. Most of it is taken incidentally by small tuna boats while fishing for tuna. Quite often one of these boats will be forced to start home only partly loaded and will take any yellowtail it may find on the way. Some of these boats are purse seiners and others use live bait. For some reason all the seiners unload at Los Angeles and almost all the bait boats at San Diego.

Some Mexican yellowtail is taken by live bait market boats which are intermediate in size between the local live bait boats and the small tuna boats. The larger tuna clippers do not bother with yellowtail, the price is too low, and they can stay out longer and go farther in search of the higher priced fish.

The amounts of yellowtail landed in California are shown in figure 23. The tonnages were greatest during the "eat less meat" days of

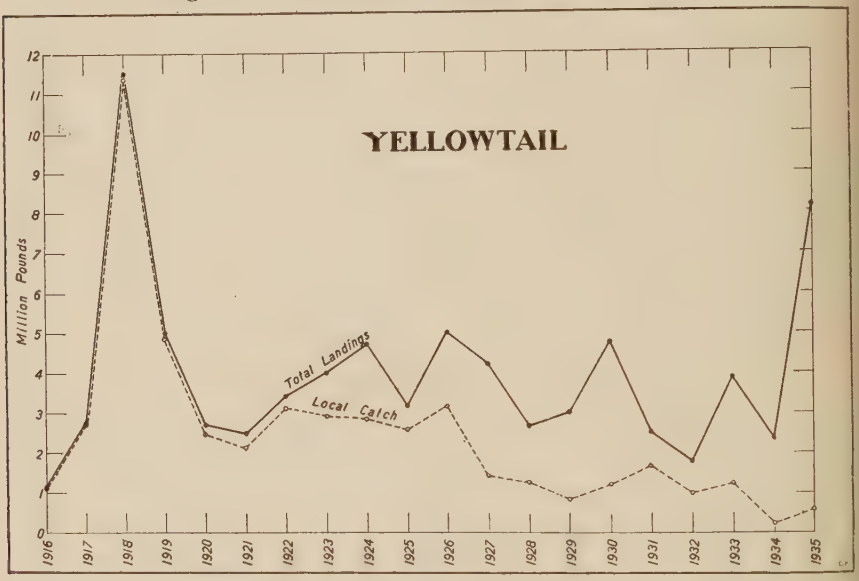

FIG. 23. The broken lines show the catch made in California waters as compared with the total landings, which also include the yellowtail from Mexican waters.

the war. Since that time there has been no marked tendency toward either an increase or a decrease in the total landings. However, there has been a very marked decline in the yellowtail caught in local waters. An increase in Mexican-caught fish has made up the deficit. This would appear to be almost perfect evidence of exceedingly serious depletion, the assumption being that the fishermen have been unable to supply the markets with locally caught yellowtail, hence the demand has been met with imported fish. This may be the case, but the depletion is certainly not as serious as that long continued drop in locally caught fish would lead one to believe. In the first place, these figures do not include sport-caught fish. The sport catch in late years has been far larger than the commercial catch and has been increasing. In addition there has been legislation which has cut down the local catch. Purse seines may not take the yellowtail, barracuda or white sea-bass between May and July. This reduces the catch at Los Angeles but not at San Diego, as no seiners operate out of the latter port.

Another law, passed in 1933, prohibits the canning of yellowtail, *except* that which is caught south of the international line. This law had quite an effect in stimulating the Coronado Island fishery. The local live bait boats at San Diego had been in the habit of selling what yellowtail they could to the markets and taking the rest to a cannery.

To continue this practice all they had to do was to fish south of the international line. The Coronado Islands were very handy and the fishing there was excellent. As a result when there was a sudden increase in yellowtail canning in 1935 nearly three and a half million pounds were brought in from this one small area.

Both of these laws are a step in the right direction as it certainly would be very poor judgment to permit wide open seining and canning of yellowtail and particularly of local yellowtail. However, neither law goes far enough. All seining for yellowtail, barracuda and white sea-bass is open to a great many objections, not the least of which is that the purse seiners flood the markets and force prices down to the point where neither they nor anyone else can make any money. Protecting only the locally caught yellowtail from canning would be much more effective if it were not possible for the boats to take great quantities of this migatory fish within ten miles of the international line. At present there would seem to be no objection to the canning of yellowtail from far down the Mexican coast. As mentioned, this fish comes up on good sized boats and the loads are often large enough to flood the markets—at present the boats can prevent this by selling part or all of a load to a cannery.

The canning of yellowtail has never been very heavy. The greatest amount packed was six and a half million pounds in 1918. From 1919

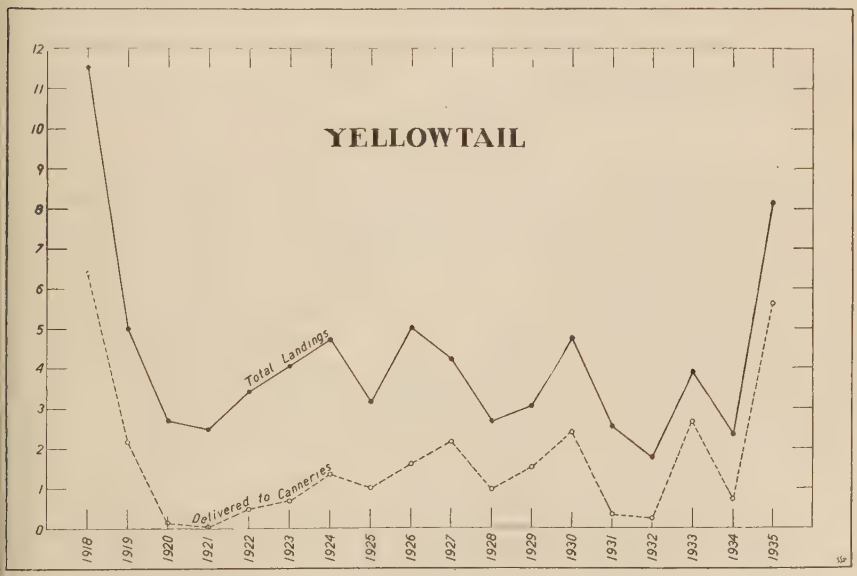

Fig. 24.

to 1934, the figure fluctuated all the way from practically nothing to two and a half million pounds. In 1935 there was a marked increase—over four and a half million pounds were canned.

California yellowtail and those from the Coronado Islands should be regarded primarily as sport fish and should be closed to canning and seining, but there should be no attempt to prohibit commercial hook and line fishing for yellowtail. If this were done the income of too

many San Diego fishermen would be cut to the point where they could no longer make a living, and these fishermen do no particular harm to the fishery. At present there would seem to be no point in placing any restriction whatever on fish from far down the Mexican coast.—*Donald H. Fry, Jr.*

Reference (see page 164): 107.

Fig. 25.

FLATFISH

Fishing for flatfish dates back to the early 1870's, when the Spanish and Italian fishermen of San Francisco began taking these fish by means of a paranzella drag net, of Mediterranean origin, which is towed on the bottom of the sea behind and between two boats. This is one of the first fisheries developed in California, and in the early days shared honors with the salmon as one of the largest fisheries of California. Its history and growth are picturesque; first, small lateen sail boats caught flatfishes in San Francisco Bay, and later when the rich catches in this area decreased, these boats ventured out farther to the open sea where the fish were more plentiful. Then in 1885, the first steam trawler was used, followed in 1909 by the introduction of small boats propelled by gasoline motors. Now the gasoline trawlers and all but one of the steamers have been superseded by diesel-powered craft.

During this period of development, the fishery expanded to other ports and localities in the state, where large amounts of sole, sand dab, flounder, turbot and California halibut were taken and marketed. However, San Francisco has always received the largest proportion of these fish, which make up the bulk of all the fresh fish marketed in that port. The people of San Francisco have developed a taste for flatfish so that no dinner at the city's world famed restaurants is complete without this sea food.

The drag boats deliver their catches daily. The fish are almost

entirely sold fresh, and in the northern part of the state the fish are in the consumer's hands 12 to 36 hours after coming out of the water.

The drag net scoops up the fish on and near the bottom and does not discriminate as to species or sizes except those that escape through the meshes of the net. The various species of the bottom-dwelling flatfishes are caught in this manner, with the exception of the northern halibut. Although this halibut is taken in drag nets to some extent, a large proportion of it has always been caught by individual fishermen with long set lines with baited hooks.

The state landings for all flatfishes, except northern halibut, is shown in figure 25. Different parts of the state have large deliveries of various species, although in northern California sole comprises the greatest part of the catch and in southern California the California halibut accounts for a big proportion of the total.

The following accounts of the individual species give information on the distribution and catch peculiar to each one.

Northern Halibut

The northern halibut fishery is the second in importance in the north Pacific. It has its origin from Seattle and British Columbia, where hardy seamen went out in small boats to the halibut banks and set their gear of long lines with baited hooks. From the north, the fishery spread to northern California in the prospect of new banks and so became established there.

Landings of northern halibut (*Hippoglossus stenolepsis*) are made almost entirely in northern California, Eureka being the port of largest deliveries. Until about 1926, this was an unimportant fishery in this region, landings never reaching over 200,000 pounds in a year, but from 1926 to the present time the amounts of halibut have steadily though erratically increased to over one million pounds, probably due to two factors—increasing numbers of fishermen and development of new northern fishing grounds.

Fig. 26.

Eighty-seven per cent of the landings are made at Eureka, 12 per cent at San Francisco, although the halibut brought to San Francisco are caught north of Point Arena. The other one per cent is shown as being delivered to Crescent City and a very few at Los Angeles, having been transported to this latter port, in order to obtain a better price, by the fishing vessel which caught them in the waters north of Point Arena.

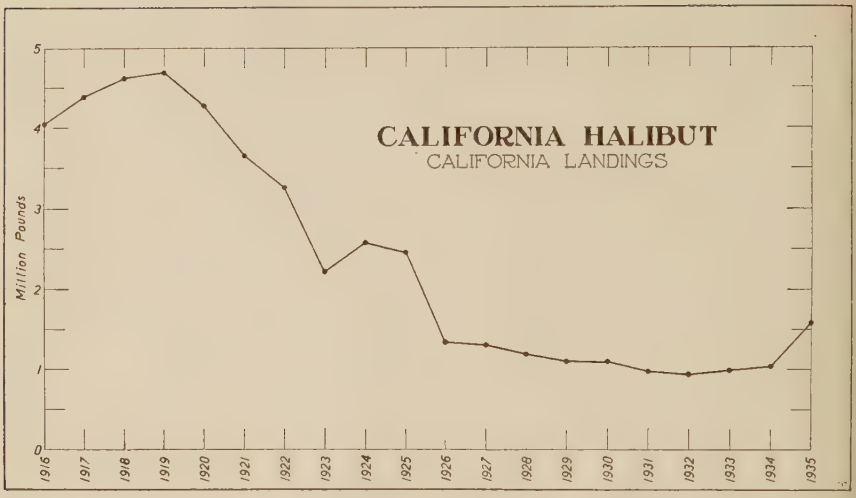

FIG. 27.

Eighty per cent or more of the catch is made by long lines (set lines with baited hooks dropped on the bottom of the sea), and the rest is made by drag nets.

Regulations by the International Fisheries Commission (United States and Great Britain), whereby the northern halibut season is closed and opened each year according to quotas from various areas, govern the fishery.*

California Halibut

In former years the California halibut (*Paralichthys californicus*) was one of the principal market fisheries in southern California, the total catch in 1919 amounting to 4,600,000 pounds. Deliveries were made principally at Los Angeles, San Diego and to a lesser extent at

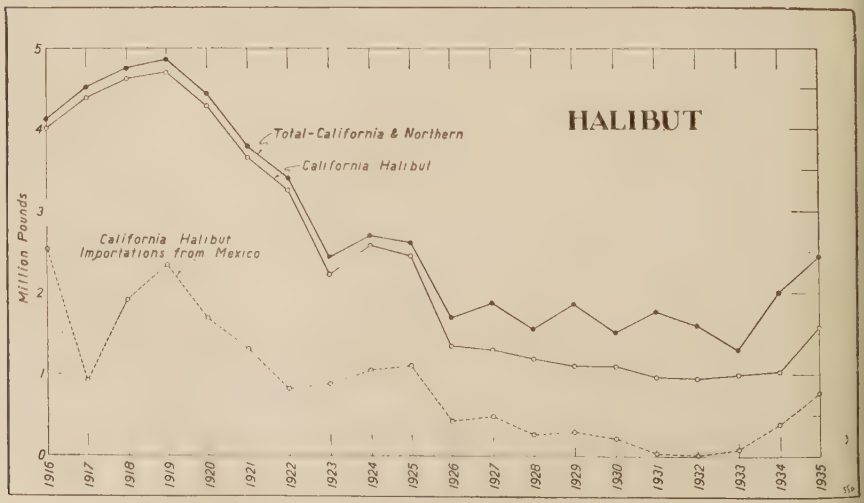

FIG. 28.

* See Reports of the International Fisheries Commission.

Santa Barbara. On an average, approximately 35 per cent of the landings of Los Angeles and San Diego were halibut imported from Mexican waters; some years the percentage was higher than others, ranging between 63 and 1 per cent.

From the peak year in 1919, the total catch declined very rapidly to a low in 1932, just over one million pounds. The decrease was due largely to depletion of the fishery, and somewhat to legal restrictions enacted in 1924, which prohibited drag net fishing south of the Ventura-Santa Barbara County line. However, it was still legal to take halibut with trammel nets of 8-inch mesh in all districts south of Pt. Conception. At the present time (1935) only 15 per cent of the halibut taken (principally with drag net) are delivered at Santa Barbara, 38 per cent at Los Angeles, 43 per cent at San Diego. The latter two ports receive all the Mexican importations which are included in the total landings. Catches delivered at Los Angeles and San Diego are taken by trammel nets almost exclusively. Only 4 per cent of the total catch is landed north of Pt. Conception, 3 per cent at Monterey taken by lines and drag nets, and 1 per cent at San Francisco caught in drag nets.

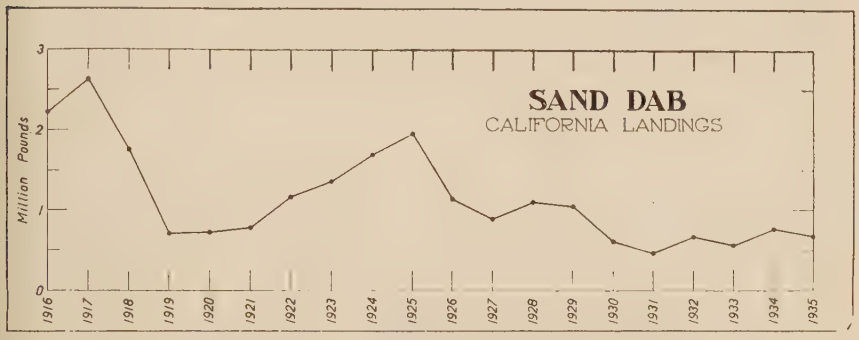

FIG. 29.

Sand Dab

Sand dabs, small flatfish rarely exceeding a half pound, represent almost entirely one species (*Citharichthys sordidus*). However, a few of the largest of another species (*Citharichthys stigmaeus*) are utilized. Ninety-two per cent of the catch of sand dabs is landed in San Francisco, with 6 per cent in Monterey and the other 2 per cent principally in Los Angeles.

Approximately 95 per cent of the poundage is taken by drag nets off San Francisco and Monterey, the rest is caught by hook and line. The highly advertised and talked of "Catalina sand dab," taken off Catalina Island by hook and line, is the *Citharichthys stigmaeus* also found in the northern waters. In southern California, it has been given the local name of Catalina sand dab.

In years past the sand dabs commanded a much more prominent place in the state's fresh fish landings. In 1917, more than $2\frac{1}{2}$ million pounds were landed only to fall to below 800,000 pounds in 1919–1921 during the depression. However, a steady increase took place until 1925, when the catch reached almost 2 million again, but succeeding

years showed a tremendous decline to less than 500,000 pounds in 1931 and only a slight revival in following years.

Part of the decline is due to the use of large mesh in drag nets since 1925. The dab is naturally a small fish so larger amounts of the small individuals escaped out of the net. However, preliminary work on the average boat catch per day indicates that depletion is the principal reason for its decline.

Turbot

Turbot landings consist principally of two species of *Pleuronichthys,* one of *Hypsopsetta,* and occasionally in southern California of the two other minor species of *Pleuronichthys.* The largest landings are made in San Francisco, 12 per cent is delivered at Monterey, and the remainder is reported from Los Angeles and a very few at Santa Barbara.

Approximately 86 per cent of the turbot catch is delivered at San Francisco. Drag boats, operating in 20 to 70 fathoms of water, account for 96 per cent of the San Francisco catch and 90 per cent of the Monterey catch. The balance reported is taken by lines and gill and trammel nets.

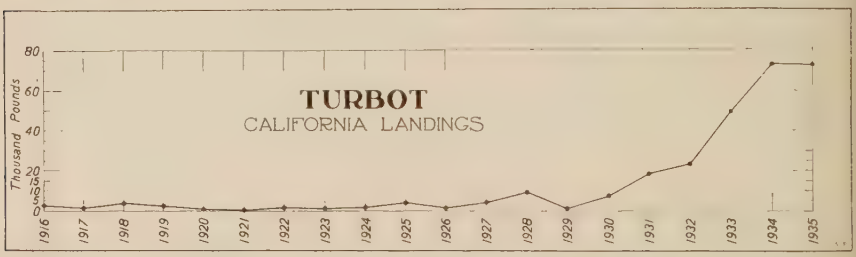

Fig. 30.

From records of catch, the fishery appears to have been insignificant until recent years, but this is not true. During former years the turbots were not separated from the sole catch; and even now in Santa Barbara region no separation is made, although fair amounts of the flatfish catch consist of turbots. As a consequence, we have no idea what the turbot catch was in earlier years. However, for the past two years, 1934 and 1935, it is felt that the reported catch of Monterey and San Francisco is accurate. From meager information available, we estimate that 30 per cent of the Santa Barbara catch of "soles" is turbot, which are taken largely in drag nets.

Starry Flounder

Flounder landed in California consist of one species—the starry flounder, *Platichthys stellatus.* It is distributed from southern California to the Arctic Ocean and found in relatively shallow waters up to 30 fathoms. Ninety-seven per cent of the state's catch is landed in San Francisco and 2 per cent in Monterey, practically all being taken by drag nets. Only 1 per cent of this species is taken in other parts of the state, principally Eureka; a few hundred pounds in the past have been reported as taken in southern California but recorded as sole. Also, occasionally, a few hundred pounds are brought in from

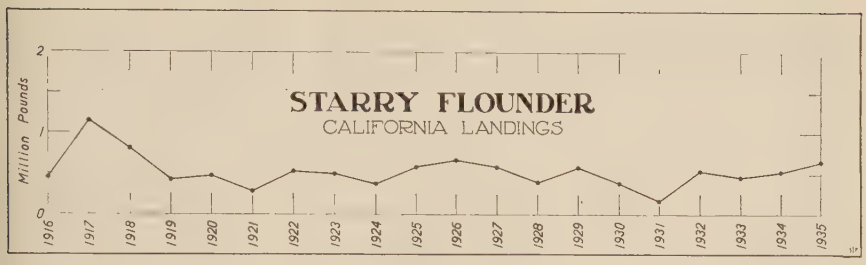

FIG. 31.

Mexican waters and recorded as flounder, but we are not sure that these catches are of the starry flounder. In any event, the amount is so small that it has little weight in the total figures.

The flounder fishery is a part of the catch of drag nets and has been developed along with the fisheries for sole, turbot and other bottom fishes.

It will be noticed from the recorded catch (see Fig. 31) that the yearly landings fluctuate. The high peak in 1917 no doubt is due to war production with an after-war slump in 1919 to 1921. However, the causes of the succeeding depressions in the curve are not known unless they are due to concentration of fishing in deeper waters some years and in shallower waters other years.

Sole

Sole delivered to California ports, principally San Francisco, consist of several species, the most important being the pointed-nosed sole (*Parophrys vetula*), which makes up about 65 per cent of the entire sole catch. Next in importance is the round-nosed sole (*Eopsetta jordani*), which accounts for 25 per cent of the sole taken; then rex

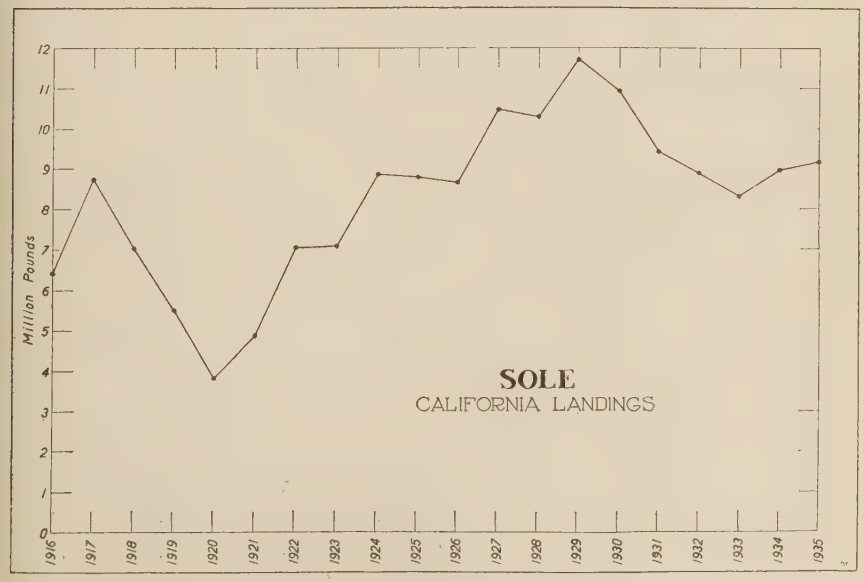

FIG. 32.

sole (*Glyptocephalus zachirus*) which makes up nearly 8 per cent of the catch. The other 2 per cent is made up of various species in the northern half of the state. These include the fringe sole (*Psettichthys melanostictus*), broad-fin sole (*Lepidopsetta bilineata*), scaly-fin sole (*Isopsetta isolepis*), and a few other unimportant species. In the southern part of the state, certain species are included in the sole catch that are separated in the north—such as the turbots (four species of *Pleuronichthys*); fan-tail sole (*Xystreurys liolepis*), found only south of Pt. Conception; starry flounder (*Platichthys stellatus*); and a few minor species. However, the take of sole south of Monterey is only 6 per cent of the state total.

Ninety-three per cent of all sole is taken by drag boats operating between Monterey and the Oregon line; 5 per cent caught off Santa Barbara, largely by drag boats; and the other 2 per cent taken by small otter trawls at Monterey and over the state waters in small amounts by lines.

Sole fishing was developed at San Francisco in the early 1870's and has made and supplied a large market in that region. As shown by our statistical records, a sharp decline occurred between 1917 and 1920 from a high point in 1917, due in all probability to the slump in prices after the World War. Since 1920, the fishery has steadily produced more and more sole as the market enlarged. In 1928, 1929 and 1930 new grounds were opened, first off Fort Bragg, then Eureka, then off Crescent City. The year 1929 saw a large catch on virgin grounds but the amount of catch decreased to a low in 1933, partially due to thinning out of fish and partially to depression prices; whereas the 1934 and 1935 catch increased somewhat because of further expansion of grounds and better knowledge of utilization on existing fishing banks.—*G. H. Clark.*

References (see page 164): 30, 32, 34, 62, 71.

ROCKFISH

The rockfishes, commonly called rock cods, have been one of the mainstays of the fresh fish markets for a number of years. During the past ten years, 1926–1935, rockfishes have consistently ranked next to sole as the most important market fish. During the previous ten-year period, 1916–1925, rockfishes were most often in fourth place, with salmon consistently first and barracuda and sole vying for second place. Since catch statistics were first recorded in 1916 and through the twenty-year period of 1916–1935, the average yearly catch of rockfishes in California has been a little under six million pounds.

The rockfishes compose a very large family, Scorpaenidae, with about 250 species inhabiting all seas, but especially abundant in the temperate parts of the Pacific Ocean. The family is most numerously represented on our California coast, where about 56 species are found. There is such similarity in a number of forms that identification of many species has been exceedingly difficult. Some of the more important forms have been provided with common names, but individual names for the entire group will have to await the arduous task of reclassification.

These fishes are caught along the entire coast and around islands wherever there is a rocky bottom. Some species are found close to shore and others at depths down to 300 fathoms. The smallest species attains

a length of only 8 or 10 inches and the largest reaches 2 to 3 feet.* All are used as food. The flesh is light colored, dry, coarse and moderately flavored.

Although most of the 56 species of rockfishes enter the catch at some time or other, over one-half of the annual deliveries is composed of the following seven: chili-pepper (*Sebastodes goodei*), bocaccio (*S. paucispinis*), yellow-tailed rockfish (*S. flavidus*), black rockfish (*S. mystinus*), and the following three which have no common names: *S. pinniger, S. miniatus* and *S. ovalis.* Of these, the chili-pepper and the bocaccio are the most important.

Aside from the true rockfishes, there are two other species belonging to the rockfish family that are delivered in minor amounts. These are the sculpin (*Scorpaena guttata*) and the channel rockfish (*Sebastolobus alascanus*). The catches of sculpin are listed separately in the statistical records, whereas the catches of channel rockfish are included with the rockfishes. Sculpin have been caught in appreciable amounts

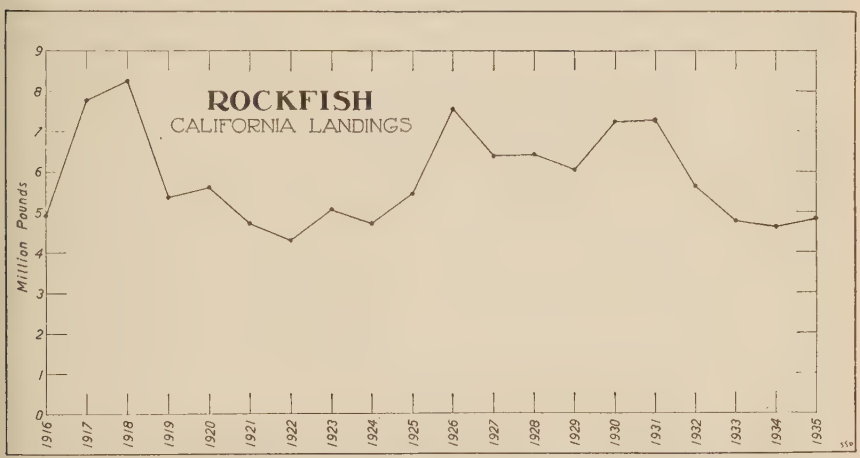

FIG. 33.

since catch statistics were first recorded in 1916. The 20-year average 1916–1935 was about 75,000 pounds annually. Channel rockfish, on the other hand, were not landed in appreciable numbers until 1932. In 1933, between 25,000 and 50,000 pounds were delivered. Channel rockfish are caught in relatively deep water, 100 to 300 fathoms, and almost exclusively with sablefish, on gear that is similar to that used in rockfish fishing.

The annual rockfish catch of California for the 20-year period (1916–1935) is given in figure 33. The highest yearly catch was in 1918 when nearly 8 million pounds were taken, and the lowest was in 1922 with about 4⅓ million pounds. Without undertaking a detailed analysis of the various influencing factors, the following general conception of the fluctuations in the catch seems probable: The consistent demand for this staple has been met by enlargement of fishing operations when

* On April 19, 1933, a rockfish (*Sebastodes pinniger*) measuring 36½ inches in length and weighing 32½ pounds was landed at Monterey. This record specimen was caught eight miles south of Pt. Sur.

necessary. In northern California, expansion has kept pace with the demand and there is yet ample room for further development. Boats fishing in San Francisco and Monterey make only one and two-day trips and rarely take ice. In southern California, it appears that the limit of expansion is being reached and it is difficult to meet the market demand. In earlier years, one and two-day trips were made as in the northern regions. However, in recent years the Los Angeles and San Diego boats have been making trips that last four to seven days, and a greater area is fished by these individual boats than those in northern California. Ice must also be taken to preserve the catch on these longer trips. The boats fishing out of these two southern ports cover the area between Ventura on the north and into northern Mexico on the south, including the islands off shore. Landings from Mexico have increased noticeably during the past two years. Examination of figure 34 shows that there has been a steady decline in the annual southern California poundage from 1931 to 1936. Northern California also shows a decrease from 1930 to 1934, but it dropped below its 20-year average for only two of the four years of decline, whereas southern

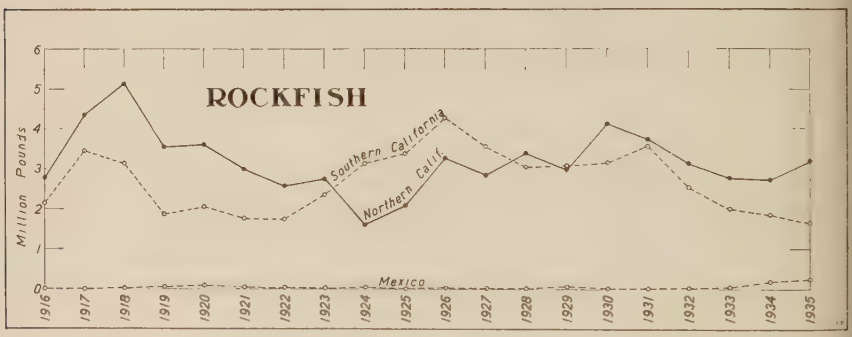

FIG. 34.

California has been below its 20-year average for all four years of the four-year decline. In 1935, northern California recovered to slightly above its 20-year average, and southern California was over one million pounds under its 20-year average, the lowest annual poundage since 1916.

During the 20-year period (1916–1935), 54 per cent of the total state catch was delivered in northern California and 46 in southern California. Since 1926, the general trend of the annual poundage for northern California has been about level and the general trend for the southern region has been downward.

It is true that during recent years in southern California there have been but a few fishermen fishing for rockfishes as compared to earlier years, and this is the main reason for the decrease in catch. Nevertheless, the fishermen have been forsaking this fishery because of the long trips necessary and because the rockfishes are so scarce it does not pay to go after them. However, the lull in fishing effort may be to the advantage of the rockfish population, as a few years of less intensive fishing will allow some measure of rehabilitation.

Southern California can increase its annual poundage by increased deliveries from Mexican waters and by developing the region from

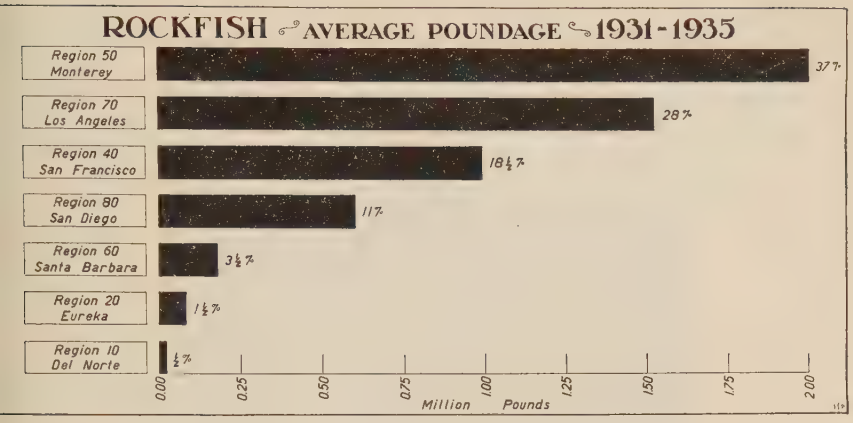

FIG. 35.

Ventura northward to Pt. Piedras Blancas. Northern California can expand further in the area south of Pt. Sur to Pt. Piedras Blancas and in the large, comparatively undeveloped region north of Pt. Reyes.

The relative importance of the seven geographical coastal regions of California, based upon the average annual poundage landed during the five-year period of 1931–1935, is shown on the bar graph, figure 35.

In figure 36 is presented the average monthly poundage of rockfishes landed in California during 1931–1935, and also includes the deliveries made in northern and southern California. The increased landings during February, March and April are probably due to the increased demand for fish during the Lenten period, rather than natural fluctuations in abundance.

During the open seasons or "runs" of some of our more valuable commercial fishes, such as salmon or albacore, there is a tendency for fishermen to forsake rockfish fishing for the more lucrative fishing.

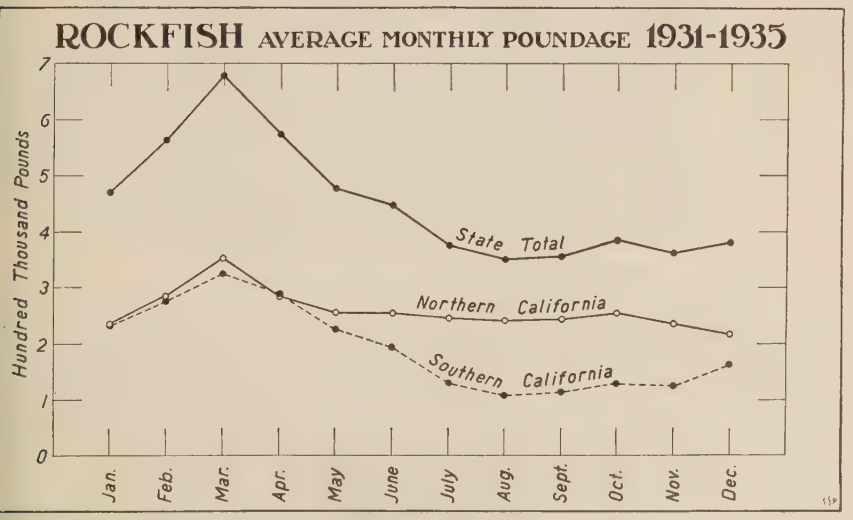

FIG. 36.

Rockfish are caught by sportsmen fishing single lines from rocky shores or from boats anchored over rocky bottom, hence the lines are weighted.

Commercial fishermen use set lines, sometimes called long lines but known locally as "trawl" lines. A "trawl" line varies from 50 to 150 fathoms in length and may bear 125 to 360 hooks, attached at

FIG. 37. Rockfish fishermen at Monterey mending their lines. Photo by J. B. Phillips.

intervals of 24 to 36 inches along the main line, by ganging or leaders of 12 to 30 inches in length. When not in use the lines are coiled in shallow baskets with the hooks stuck around the edge or coiled in flat boxes with hooks placed around a stick. The baskets are used mainly by Italian fishermen. One fisherman may have 10 or 11 of these lines, but 3 or 4 lines are all that one man can handle readily when fishing. With two men working together, about 8 lines can be handled. The lines are fished either up and down, as a hand line, or are set stretched

ut on the bottom as a set line. The bulk of the fish is captured by the atter method. The up and down manner of fishing is only used where ocks are restricted or when it is inconvenient to set the lines on the ottom. Fishing is usually done in less than 50 fathoms of water, but n some occasions sets are made in water down to 200 fathoms. When etting the lines on the bottom, several baited lines are tied together and aid out in one long series, with a rock anchor and retrieving line tied o a float and the anchor at either end. The period of time that elapses efore the string of lines is raised depends upon how fast the fish are iting, but it is usually not more than a couple of hours. When the tring is pulled, the lines are coiled again before being set out another ime.

The boat commonly used for commercial rockfish fishing is the gig oat, varying from 20 to 35 feet in length. Skiffs are used by a few ishermen who operate close to port. In southern California, the ten- lency is to use boats a little larger in size than those used in northern alifornia.

During 1935, rockfish brought the fishermen about one cent a pound nore in southern California than in northern California.* Whereas, he normal average price paid for the various species of rockfish in the outh ranged between two and six cents, the price in the north was etween one and five cents. The chili-pepper, boccaccio and yellow- ailed rockfish brought the fishermen on an average of four cents a ound in southern California and three cents in northern California. he black rockfish brought on an average of two and a half cents in outhern California, and one and a half cents in northern California. hina rockfish (*Sebastodes nebulosus*) and the black and yellow rock- ish (*S. chrysomelas*), collectively known as gopher cod or gophers to he markets, bring the highest price of all the rockfish because of their lavor and the small amounts delivered. In northern California the verage price for these latter species during 1935 was seven cents a ound.

Practically all of the rockfishes are sold in the fresh state, and the ulk of this is in the form of fillets. A very small amount of rockfish as been salted down in the Monterey region, primarily for the Portu- uese living in the inland valleys. Rockfish fillets are iced and shipped rom northern and southern California to points as far north as Seattle nd Spokane and eastward as far as Montana, Wyoming and Utah. oughly, the shipping radius may be considered as northward to Can- da and eastward to the Rocky Mountains.—*J. B. Phillips.*

References (see page 164): 25, 98.

SCULPIN AND CABEZONE

Sculpin (*Scorpaena guttata*) and cabezone (*Scorpaenichthys mar- noratus*) are landed in minor amounts in California and deserve only assing mention. Of the two fishes, the sculpin is the more important. uring the 20-year period, 1916–1935, the average amount of sculpin anded in California was about 75,000 pounds a year, and the average mount of cabezone was only about 1700 pounds a year.

The sculpin is not a true sculpin, but belongs to the rockfish family Scorpaenidae) and is frequently called scorpion, whereas the cabezone

* Prices quoted refer to fish uncleaned.

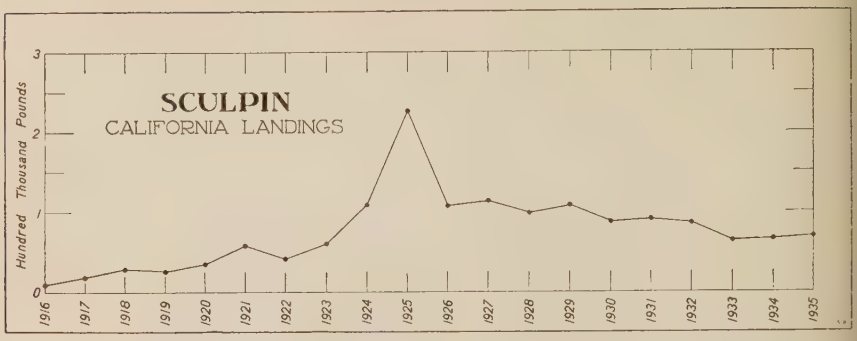

FIG. 38.

belongs to the sculpin family (Cottidae) in which are classed several smaller species found on our coast, none of which is of commercial significance.

The range of the sculpin is Monterey southward into the Gulf of California and that of the cabezone is Puget Sound to San Diego. Commercially, the sculpin is rarely taken north of Point Conception so that it is essentially a southern California fish. The cabezone is taken along the entire California coast but in greater numbers in northern

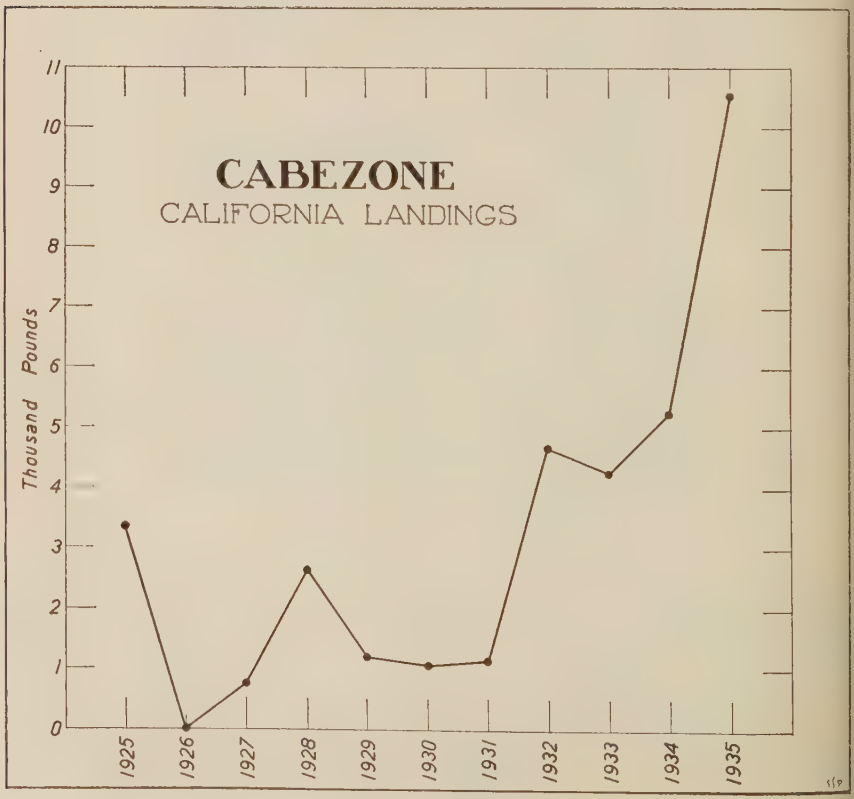

FIG. 39.

than in southern California. In earlier years, the cabezone was called sculpin in northern California.

During the past five years, 1931–1935, the average cabezone poundage has increased over its 20-year average to about 4800 pounds a year. The sculpin poundage during the same five-year period has remained about the same as its 20-year average, or around 75,000 pounds.

The largest catches of sculpin are usually made during the summer months. The cabezone catches are not great enough to determine the season of abundant catches.

The sculpin is a more desirable market species than is the cabezone. The low price that the cabezone brings fishermen (about one cent a pound in northern California) does not permit a separate fishery and it is therefore taken incidental to other fishing, mainly that for rockfish. —*J. B. Phillips.*

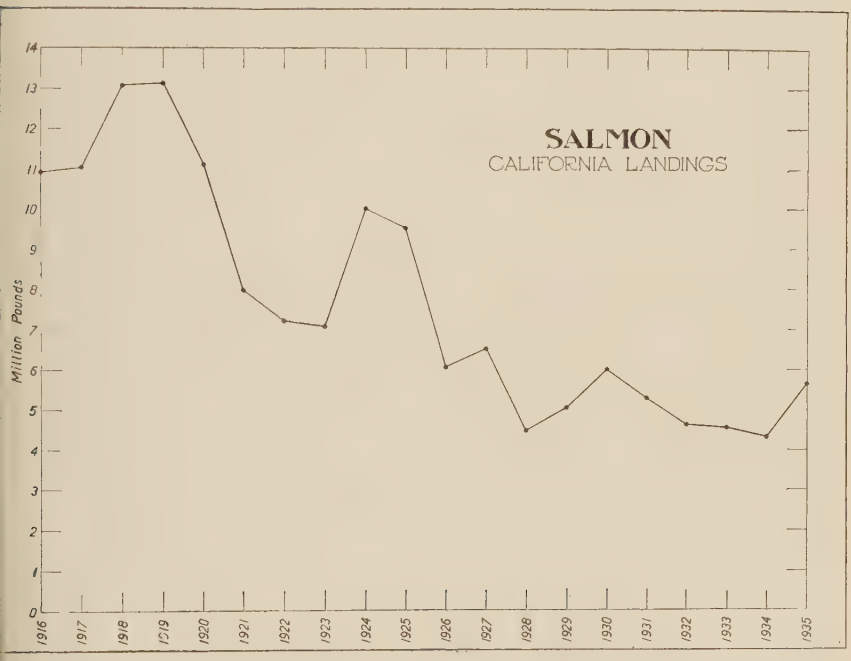

FIG. 40.

SALMON

Of the five species of Pacific salmon there are two of commercial importance in California waters, commonly known as king and silver, the king being the most abundant as well as the most valuable. The king (*Oncorhynchus tschawytscha*), also known as quinnat, chinook, tyee or spring salmon, is the largest of the five species. Adult river-caught kings average about 20 pounds in weight, although 40 and 50 pounders are common. Ocean-caught kings, many of which are immature, range from 8 to 60 pounds. The silver (*Oncorhynchus kisutch*), sometimes called coho or blueback, is next in size and very similar in

appearance. Silvers average about 8 pounds and are occasionally taken as large as 30 pounds.

The other three species of the genus *Oncorhynchus,* commonly known as sockeye, humpback and chum, range farther north and are seldom ever seen or taken in this state. An individual humpback or chum is occasionally included in the commercial catch, whereas the sockeye, which is seldom found south of the Columbia River, has been reported here on very rare occasions.

Prior to 1910 the salmon fishery rated as one of the state's principal industries; it also outranked any other fishery in this state. The industry centered principally in the Sacramento and San Joaquin rivers and San Francisco Bay, but several northern streams, Eel, Klamath and Smith rivers, also contributed to the commercial catch. There is but a remnant left of this once prosperous bay and river fishery, which for many years employed hundreds of fishermen, cannery and packing plant laborers, not to mention the help required in allied industries. During its heydey, approximately 1500 fishermen operated 750 gill nets in this fishery. There were 20 canneries operating in the bay and river regions. In fact, the salmon canning industry of the Pacific coast had its inception in California, the first cannery being operated at Washington (Broderick), Yolo County, in 1864.

In comparison, during the 1935 season there were 300 fishermen operating 150 salmon nets in the upper bay and lower river regions, this being a fair average for the past several years. And, there were 570 salmon trolling boats working off the California coast. No salmon canneries have been operated in the San Francisco Bay area for a number of years. All salmon now taken either in inland waters or by ocean trollers are sold fresh, mild-cured, salted or smoked. The last cannery in California was on the Klamath River. Since 1934, when it was closed by an act of the legislature, there has been no salmon canned for commercial purposes in this state. To prevent waste of the anglers' catch, two small sportsmen's canneries are operated on the Klamath River, but the sale of this canned product is prohibited.

Drift gill nets and bar seines were used principally for taking salmon in the bays, estuaries and rivers for many years. The first commercial netting for salmon began as early as 1850 in the Sacramento and San Joaquin rivers and San Francisco Bay area. For many years salmon were taken only by nets in the rivers and inland waters and later trolling in the open ocean was begun. With the exception of the lower portion of the Sacramento and San Joaquin rivers and the upper San Francisco Bay area, where netting is still allowed during a short season, all rivers and inland waters are closed to the taking of salmon commercially with nets or otherwise.

It appears from past records that ocean trolling for salmon on this coast first began in Monterey Bay during the early eighties, although of little consequence commercially until the late nineties. The mild-curing process of packing salmon was introduced in California about 1898, the first fish being commercially mild-cured at Monterey in 1900. This new process acted as a stimulus to ocean trolling in Monterey Bay, and trolling increased rapidly from that date until the all-time high peak of this fishery was reached in 1916. During this year a little better than 5,000,000 pounds of salmon were taken at Monterey and Santa

Cruz. From 1908 to 1914 the greatest stimulus really occurred. During that period fishing effort increased enormously. Prior to 1908 small sail boats (about 100 skiffs rigged with leg-o-mutton sails) were operating here, there being very few power boats. About this time, San Francisco Bay and river fishermen rigged their power boats for salmon trolling and sailed for Monterey Bay, many of them returning to the northern area for the fall gill-netting season. Thus they began burning the candle at both ends, taking the salmon on their feeding grounds in the sea and also during the spawning migration to the rivers. It can not be said, however, that fishing for the salmon alone is responsible for depletion in this area. Other factors, such as placer mining, power dams, irrigation and other hindrances have had their effect in depleting the salmon runs.

As the fishermen became more familiar with the trolling method and this fishery in general, they began prospecting for new grounds, migrat-

FIG. 41. Drifting for salmon on Sacramento River. Submerged diver net is held in suspension by lines extending from buoys to cork line. River steamers pass over the net without damaging it. Lines from buoy to cork line are 12 feet, nets about 100 fathoms long and 4 to 5 fathoms deep. Photo by H. B. Nidever, May 11, 1936.

ing farther north. By 1914 the good fishing grounds were fairly well located from Monterey to Point Reyes. During 1916 a few fishermen ventured to Fort Bragg and Shelter Cove, where salmon fisheries were established and have been operating since. About this time ocean trolling for salmon also began off Eureka and Crescent City. The major portion of the salmon landed in California is now (1935) taken by ocean trollers, this fishery extending from Monterey Bay to the northern boundary of the state.

Figure 42 shows the annual salmon catch by districts for the past twenty years. It will be noted that in the Sacramento River region, which also includes the San Joaquin River and upper San Francisco Bay, a rapid decline due to depletion has taken place. It is also of interest to note that in the San Francisco region, which includes lower San Francisco Bay and ocean waters from Bodega Bay to Halfmoon

Bay, and in the Monterey Bay district, which includes the ocean waters from Halfmoon Bay southward to Monterey, the catch follows very closely the trend of the bay and river fishery. This would indicate that a large portion of the ocean-caught fish taken off San Francisco and in Monterey Bay comes principally from the Sacramento and San Joaquin river stock.

Referring again to figure 42, it will be noted that the total landings for the state show an upward trend until the year 1919 is reached. This year, which happens to be the all-time peak year for California's total catch of salmon, 13,145,000 pounds were taken in the ocean and river fishery.

At this time a greater area was fished in the bay and river districts, and the Klamath and Smith rivers were also open to netting. Since

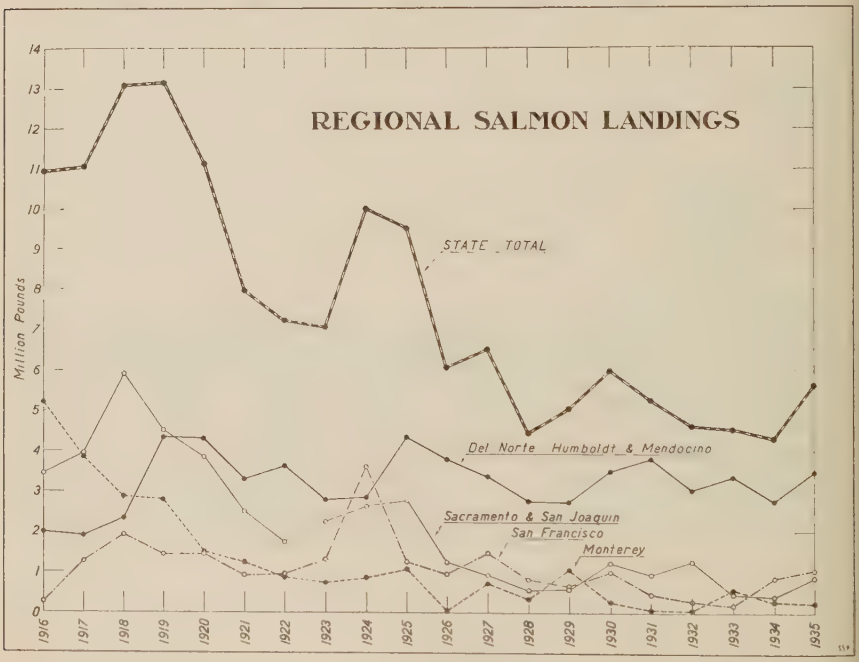

FIG. 42.

this peak year, the annual catch for the state has dropped rapidly. In 1923 or five years later, the catch amounted to 7,000,000 pounds. The two years that follow show a slight rise but in 1926, the catch dropped again, amounting to 6,000,000 pounds. From that year on to the present (1935) there has been a gradual decline in the state's total catch, with an average yearly catch of 5,250,000 pounds for the period.

During 1935 a little over 5,500,000 pounds were landed, this being an increase of better than 1,000,000 pounds over the total catch for each of the past three years (1932, 1933 and 1934). This increase occurred in spite of the fact that most of the troll fishermen at Fort Bragg, Shelter Cove, Eureka and Crescent City were on strike for 47 days during the best part of the 1935 season. This was the longest strike on record in this fishery, the strikers demanding a higher price

per pound for their catch. No doubt the catch would have increased by several million pounds had the fishermen operated at this time. All regions during 1935 show an increase over the past year except Monterey, where landings were a little lower. Although the ocean salmon fishery north of Bodega Bay still shows a healthy condition, it has declined slightly since its inception.

The trollers landed 4,768,292 pounds of salmon during 1935 and the gill netters in the bay and river district landed 887,664 pounds or 15.7 per cent of the state's total catch. The price paid to gill netters averaged about 6 cents per pound, giving them a revenue of $53,259 for the year's take. The ocean fishermen received an average of 6½ cents per pound for the troll-caught salmon. The price varied during the year from 10 cents the first part of the season for all sizes to 4½ cents for small salmon weighing less than 16 pounds, and 8 cents for large fish 16 pounds or over. A number of fishermen at Fort Bragg and Eureka sold and mild-cured their own fish through a cooperative selling organization. At 6½ cents the troll fishermen would have received $309,938 for their catch.

Both kings and silvers are included in the ocean catch totals, all being classified merely as salmon. Several attempts have been made to segregate them in order to determine the proportionate amount of the two species taken in the ocean catch. Only kings are taken in the Sacramento and San Joaquin rivers. For some reason silvers have never inhabited these waters. Fishermen and dealers who catch and buy the ocean fish in most cases make no attempt to separate the two species. Small kings are included with the silvers and are bought and sold as small salmon, generally bringing the same price. Therefore, from the dealers' standpoint there is no need for segregating the two species.

During 1935 several of the larger dealers at Eureka were asked by the Division of Fish and Game to keep a daily estimate of the proportion of the two species delivered to them by the fishermen. From their estimates an average of 57 per cent proved to be silvers. This was rather surprising, although it has been known that a large proportion of the catch landed at that port was silvers, it has always been presumed that kings predominated. It is possible that if depletion is taking place in this fishery it is on the side of the kings and that the silvers are withstanding the strain of the fishing. Silvers run in a great many of the smaller streams not inhabited by kings. This fact may account for their greater abundance.

The Klamath and Smith river catch figures have been included with the ocean catch of the north. Had they been omitted, the plotted line showing the trend of the northern ocean landings (see Fig. 42) would fall to zero in 1916, as this fishery had just begun to develop at that time. Klamath and Smith river catches were included with all ocean-caught fish from 1916 to 1933, inclusive, these rivers being closed in 1933 permanently to commercial fishing. The Eel and Mad river catches were also included up to 1921 at which time these rivers were closed to netting.

The exploitation of the ocean fisheries north of Point Reyes and Bodega Bay during 1916 to 1919 brought about a rapid increase in the state's total catch, which reached its highest point during this period,

although the Sacramento River, San Francisco and Monterey bay fisheries during this time were on the decline. After reaching the peak of 13,145,000 pounds in 1919, the total catch declined, apparently because of the falling off of the Sacramento and San Joaquin rivers, San Francisco, and especially the Monterey bay landings.—*H. B. Nidever.*

References (see page 164): 28, 36, 87, 92.

SHAD

The shad fishery centers in the San Francisco Bay, Sacramento and San Joaquin River area. A few are taken in ocean waters along the entire coast from San Diego to Crescent City and individuals are generally taken each year in several of the larger northern California streams.

Shad (*Alosa sapidissima*) was first introduced in California in 1871 by the California Fish Commission assisted by the U. S. Fish Commission (now the U. S. Bureau of Fisheries) and the New York Fish Commission. The success of this achievement in the art of fish culture was due to the energy and initiative of the first California Fish Commissioners* and the great skill of the famous fish culturist,

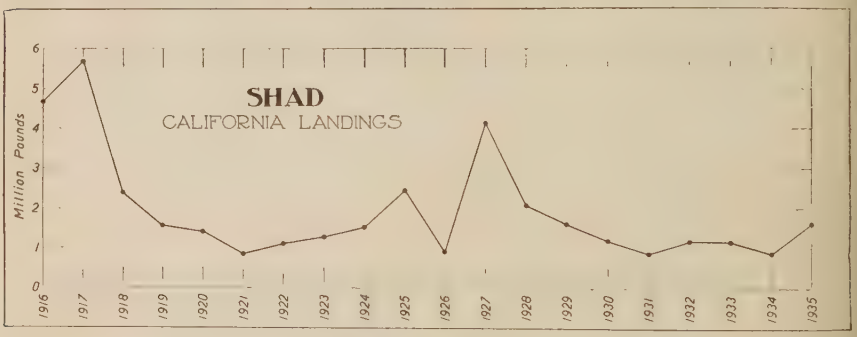

FIG. 43.

Mr. Seth Green of the U. S. Fish Commission. As an experiment, Mr. Green left Rochester, New York, on June 20, 1871, with 15,000 shad fry just hatched, contained in eight tin cans holding twelve gallons of water each. Seven days later he arrived at Tehama, California, with 10,000 of the fry in good order and liberated them in the Sacramento River at that point. A second plant of 35,000 fry was made in the river at the same point by Mr. Livingston Stone in 1873. Later, between 1876 and 1880 several subsequent plants, totaling 574,000 shad fry, were made by the U. S. Fish Commission. The fry were brought overland in an aquarium car from streams on the Atlantic coast.

The shad have had several natural advantages in their favor, which have contributed to their survival. Feeding conditions in this area of the Pacific Ocean are ideal. The Sacramento and San Joaquin river and delta region afford accessible spawning areas. Their spawning runs do not extend to the far reaches of the main streams and their tributaries as do those of salmon and trout, and this eliminates to a great extent such hazards as power and irrigation diversions, dams and

* Messrs. B. B. Redding, S. R. Throckmorton and J. D. Farwell.

canals. They are not often taken by hook and line as are most other species, nor are they taken in the ocean to any extent except incidentally with nets that are being used for other fish.

Under the present fishing laws the shad are well protected. They are taken commercially during a three-month open season extending from February 15 to May 15 by drift gill nets ranging from 150 to 300 fathoms in length with a minimum stretched mesh of 5½ inches.

The fishing district is confined to a small portion of the upper San Francisco Bay and lower river and delta region. Engaged in this fishery are about 200 gill net boats, each carrying a crew of two fishermen. Both salmon and striped bass, which run in the same waters, are taken incidentally in shad nets, it being practically impossible to drift for any one of the three varieties without taking the others. The most successful shad net is of 5¾ to 6¼ inch mesh, 6⅛ inch being the most efficient. This size will also gill salmon and striped bass. The mesh

FIG. 44. Suisun Bay. Shad fishermen picking up the net. The same type of boat and net are used for salmon, shad and striped bass in these waters. The size of the mesh in the net determines the species caught. Photo by H. B. Nidever. April 21, 1936.

of a practical salmon gill net ranges from 7 to about 9½ inches, a few are 10 inches. These nets take a few striped bass and a few shad during the shad and bass runs. Before the net fishing for striped bass was prohibited (1931) a 5½-inch mesh net was used for taking striped bass. This size mesh also takes a few shad, especially the males which are smaller than the female fish. It also takes some salmon. The same boat is used and the whole operation is similar for taking any one of the three species, the only difference being that the size of the mesh in the nets selects the species desired.

In the trade the male shad is designated as buck and the female as roe shad. Because the roe or eggs are the most valuable part of the fish, roe shad bring the highest price to the fishermen. Naturally in this case the fishermen attempt to take as much of the roe shad as possible. The roe shad is the larger of the two and gills in a little larger

mesh net, the larger mesh allowing a good portion of the bucks to pass through. The average weight of the roe shad when taken in the bay and river is a little better than 5 pounds. Buck shad average 3½ pounds in weight.

A large part of the shad and shad roe is sold fresh locally. For the past ten years an average of about 14 carloads has been shipped to eastern points each year, principally Chicago, New York and Boston. The fish are also canned, a few are mild-cured and salted.[1] Considerable roe are hard-frozen and glazed during the season to be held for future local consumption and for eastern shipment. A fairly large proportion is canned each year. Most of the canned shad and shad roe go to eastern and foreign markets.—*H. B. Nidever.*

References (see page 164): 54, 69, 91.

STRIPED BASS

Striped bass have thrived from the time they were introduced into California waters and have not only furnished this state with a choice food fish but also with one of the gamest of sport fishes. Transported from New Jersey, striped bass (*Roccus saxatilus*) were first introduced into California waters in 1879. In 1882, another plant was

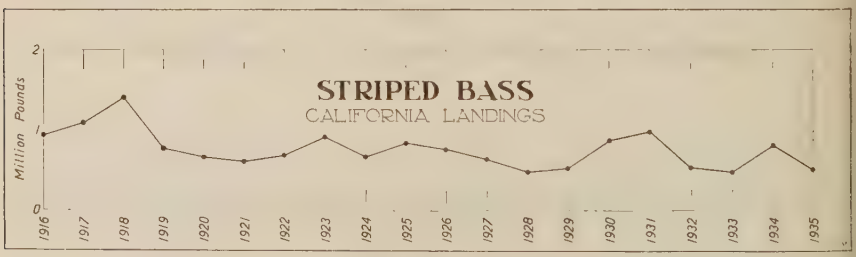

Fig. 45.

made, the two plants totaling 435 striped bass. They were sold in the San Francisco markets as early as 1889, ten years after their first introduction. This is probably one of the most remarkable cases of survival and acclimatization of introduced species.

They increased from the start and have distributed themselves to other points along the coast, although commercial fishing has been confined to certain restricted areas in the San Francisco bay and river region. These fish have extended their runs many miles up the Sacramento and San Joaquin rivers and their tributaries; they inhabit all sloughs and cuts throughout the delta region, which alone consists of over seven hundred miles of waterways.

Shortly after their introduction they found their way to Monterey Bay and to the streams, sloughs and estuaries entering it. They moved northward into the Russian River and to several bays and lagoons just north of San Francisco. The ocean area, lying between Monterey Bay and Russian River including the coastal streams in this region, seems to be the limit up to this date of any important migrations from and to the San Francisco Bay and river region. Striped bass have

[1] For records of the canned shad and canned roe, also mild-cured shad, see Division of Fish and Game yearly "Statistical reports on fresh and canned fishery products," by S. H. Dado.

been occasionally taken as far south as Los Angeles County, and a few individuals have been reported from the Eel, Klamath and Smith rivers to the north. Within the past few years they have also found their way into Coos Bay in Oregon waters.

Investigations of the life history of the striped bass on this coast, made by the California Division of Fish and Game, have proven fairly well that the nursery grounds of most striped bass taken in California

FIG. 46. Suisun Bay near Spoonbill Slough. Twelve-pound striped bass taken in 6¼ inch shad net. Striped bass returned to water alive when extracted from the net. Few striped bass live after having been gilled. Photo by H. B. Nidever, April 21, 1936.

waters are within the Sacramento and San Joaquin rivers and their delta, there being a well-defined feeding and spawning migration to and from these areas.

For many years after the introduction of these fish, they were not appreciated by the majority of anglers, who apparently overlooked their gameness and fine eating qualities and did not realize that they could readily be taken with hook and line. During the past twenty years, however, the bass have come into their own as one of the sports-

men's favorite fish. Sportsmen now enjoy taking this game fish practically the year around in San Francisco Bay and the streams and sloughs entering it. For many the pursuit of this popular fish is their sole week-end diversion. Although there never has been a record kept of the amount of striped bass taken by anglers, it has been estimated that it is equal to and possibly greater than the commercial catch.

The Division has been on the alert to further the protection and welfare of this fishery from its inception, having safeguarded it by continuous observations, investigations, and suggestions for legislative measures when necessary. Many laws have been passed and amended by the state legislature for striped bass protection. In fact the question of striped bass legislation has been one of the most controversial subjects between commercial fishermen and sportsmen brought before the fisheries committee of the legislature at each session for many years. In 1935 commercial fishing was prohibited and striped bass were taken off the market.

Fortunately the survival of this fish is favored in many ways. In the first place it is a spiny-rayed fish; active and predacious, it preys on most all other varieties found in these waters. Its natural environment, its feeding and breeding grounds are adequate.

Previous to 1931, when commercial fishing for striped bass with nets was prohibited, it supported a fishery of from 175 to 200 small commercial fishing boats, employing from 350 to 400 fishermen. The average yearly catch for the past ten years, 1926–1935, inclusive, amounts to about 658,000 pounds, which at eleven cents per pound (the average price paid during this period) realized $72,380 per year to the fishermen.—*H. B. Nidever.*

References (see page 164): 29, 31, 33, 46, 80, 91.

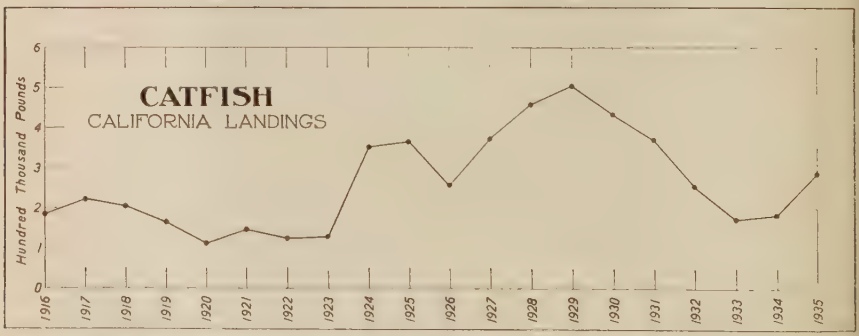

FIG. 47. Yearly totals represent "dressed" weights. Catfish lose about 50 per cent in cleaning.

CATFISH

Since their introduction into California waters the catfish have thrived, developing into one of the important fisheries of the state. They have done especially well in the Sacramento, San Joaquin, the delta area of these rivers, and in Clear Lake. They are also found in other streams and lakes throughout the state where they have been transplanted from the original stock. The two introduced species have proven to be all that was expected of them by the former California

commissioners who were responsible for bringing them from the Schuylkill River, Pennsylvania, in 1874 and later from the Missouri River.

These introduced species have been known here by various common names, the fork-tail having been called channel catfish, blue catfish, white catfish, Schuylkill catfish and Potomac catfish. The square-tail was also known as the horned pout, the yellow or golden catfish, the bullhead or Sacramento catfish. In establishing official common names for the commercial fishes of California, fork-tail (*Ameiurus catus*) and square-tail (*Ameiurus nebulosus*) were given these two species.

FIG. 48. Georgiana Slough, Sacramento River. Fyke net used for catfish hoisted on derrick for repairs, tarring and drying. Photo by H. B. Nidever, May 5, 1936.

The commercial fishery for catfish, which centers in the lower Sacramento and San Joaquin rivers and their delta, ranks in point of landings and value above all other fresh-water fishes taken in California, such as carp, hardhead, Sacramento pike, split-tail and sucker. This comparison does not include salmon, shad and striped bass which are anadromous fishes running from fresh to salt water.

This fishery is amply protected by law and is apparently holding its own under the present regulations. Fyke nets are now used entirely

for taking catfish in the river fishery. A limit mesh size of 2½ inches, stretched measurement, in all fyke nets is required.[1] The fishing is confined to the main Sacramento and San Joaquin rivers and several of the main connecting sloughs. The greater portion of the delta area, which consists of several hundred miles of sloughs and dredger cuts, is closed to the use of fyke nets or any type of commercial fishing. There is a closed season for fyke nets during the spawning time—May, June, July and August.[2] The best months for fishing are March and April in the spring and September and October in the fall.

The Clear Lake fishery is carried on with hook and line only, the use of fyke or other nets being prohibited in this district. It is also provided that catfish taken commercially in Clear Lake may be sold only within the immediate vicinity (Fish and Game District 2).

The revenue derived by commercial fishermen in the lake and river fishery averages about $26,000 annually. In the Sacramento

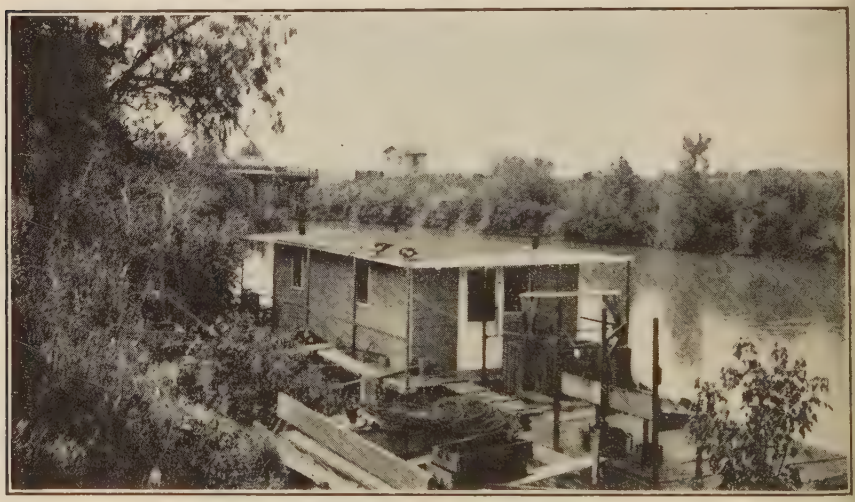

FIG. 49. Georgiana Slough, Sacramento River. Catfisherman's ark and work barge. The fisherman and his family usually live in the house boat and move from one fishing ground to another. The nets are mended and catch prepared for market on the barge. Photo by H. B. Nidever, May 5, 1936.

and San Joaquan rivers and the delta area, there were about 50 fishermen operating 900 fyke nets during 1935 and on Clear Lake 22 fishermen were engaged in taking catfish with hook and line. The number of fishermen operating and the amount of gear used have varied little in the past ten years, the fishing effort remaining fairly constant. However, it will be noted by referring to figure 47 that annual landings vary somewhat from year to year. These fluctuations are caused principally by legislative measures, weather and economic conditions. There are apparently no signs of depletion.

Practically all the catfish are cleaned by the fishermen and the receipts issued by the markets, from which our statistics are taken,

[1] A minimum size limit of 7 inches in length, dressed (skinned, heads off), or 9 inches undressed (in the round) is also provided by law in all districts.

[2] There is no closed season for the angler. Hook and line fishing may be carried on during the entire year in any district.

represent "dressed weight" and the price paid is also on the basis of cleaned fish. As these fish lose about 50 per cent when dressed, the actual weight of the fish represented in the graph of yearly totals should be doubled to give a true picture of the catfish catch in the round.

Few square-tails are taken in the commercial fyke net catch, perhaps less than 1 per cent; the fork-tails making up practically the entire catch. On Clear Lake, however, a larger proportion of square-tails is taken by line fishermen.

For the past fifteen years the spotted catfish (*Ictalurus punctatus*) has been taken in the Colorado River by southern California anglers. There seems to be no available information recorded as to how these catfish got into the Colorado, although it is reported by several sportsmen who have taken these fish and are more or less familiar with them that they were planted in the river by sportsmen in Utah. There is another smaller variety, possibly the square-tail, taken in this state only in the Colorado River or in irrigation canals connected directly with it.—*H. B. Nidever.*

References (see page 164): 52, 68, 98.

FRESH-WATER ROUGH FISH

The first explorers to reach the Central Valley of California marveled at the abundance of fish life in its rivers and sloughs. They also marveled at the generally poor eating qualities of these same fish. With the exception of the salmon and Sacramento perch all of the fish were coarse and bony. The Indians utilized the fish to a great extent but the white explorers and settlers scorned them. So it is today; the market for the so-called rough fish is limited and the fishery for them is of minor importance.

A great many species of rough fish are native to the Central Valley. Most of them are small in size, useful primarily as forage fish for larger species, but several attain food-fish size. Five species are of some commercial importance. They are:

Hardhead	*Orthodon microlepidotus*
Hardhead	*Mylopharodon conocephalus*
Split-tail	*Pogonichthys macrolepidotus*
Sacramento pike	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentalis*

The last named is a member of the sucker family; the rest are in the carp or minnow family. The Sacramento pike is one of the largest of all minnows, attaining a length of over 3 feet. The other species seldom exceed 20 inches. All have a rather pleasing sweet flavor although the flesh is soft and full of bones.

In an effort to improve the quality of fish in the lowland waters of California, several species of food and game fish have been introduced during the last 60 years. The following species have become established: the anadromous striped bass and shad, and the fresh-water carp, black bass (3 species), sunfish (2 species), crappie, calico bass and catfish (2 species). All of these fish are of value as food or game or both. Of them, only the carp (*Cyprinus carpio*) is classed as a rough fish. Within a few years of its first introduction in 1872, carp was taken in commercial quantities. Its fishery has for the most

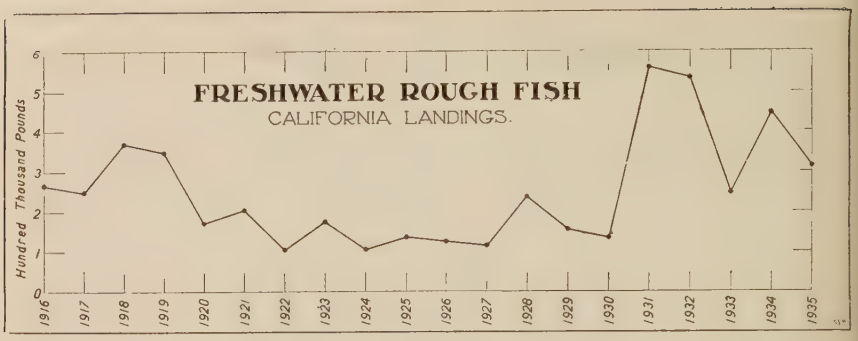

Fig. 50.

part paralleled the fishery for native rough fish and it is generally included with that group.

The largest markets for rough fish are among the local Jewish and Chinese populations, both of which prefer living fish to dead. All six species of rough fish will live for long periods in small containers and thus are esteemed by both Jewish and Chinese consumers. Because of the Chinese fondness for these fish they are often called "Chinee fish." The price for live fish is very good, especially in the case of hardhead which sometimes bring the fishermen as much as 18 cents per pound. The same fish sold dead are worth but 3 or 4 cents.

Years ago, when rough fish were more abundant, the fishery for them was of much more importance than it is now. In the early years of this century carloads of carp were shipped east, and sales of hardhead and Sacramento pike were fairly heavy. However, reclamation projects ruined many square miles of the best spawning and feeding grounds, irrigation districts diverted water from additional shallow areas and unscreened irrigation ditches caused the destruction of millions of young fish. Washington, Buena Vista and Tulare lakes and Sacramento Slough, once notable fishing areas, are now virtually dry. The former good market for rough fish has vanished because the fish have become too scarce to furnish a steady supply. After the World War period of high catches, landings declined markedly but have remained fairly constant since 1922 (see Fig. 50). A sudden increase occurred in 1931, due to special fishing operations employed to remove rough fish from Clear Lake (see page 65). The catch trends of the individual species, except the hardhead, roughly conform to the same pattern as

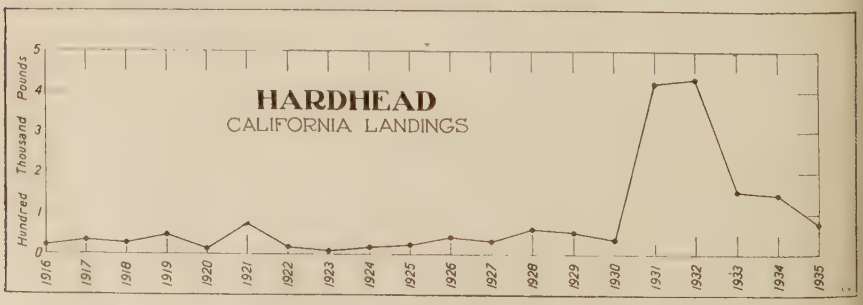

Fig. 51.

the combined catch (see Figs. 51–55). The hardhead, being the most valuable, is the object of more intensive fishing, and is seldom thrown away, which is frequently the fate of some of the other species. Hence the catch has remained fairly constant; from 1916 to 1930, annual landings of hardhead averaged 35,000 pounds with very little annual deviation. The carp catch is the most erratic, as this fish is from time to time the object of extermination campaigns in one lake or another.

Rough fish are taken commercially in three general localities. First in importance is the lower part of the Sacramento-San Joaquin River system with its many interlocking, slow moving rivers and sloughs. Second is Clear Lake, a large and beautifully situated body of water in Lake County. The third locality includes the natural and artificial lakes of southern California.

As conducted today, the fishery for rough fish in the Sacramento-San Joaquin region is a side line to the capture of catfish. The fishermen usually catch rough fish incidentally in the fyke nets set for catfish, although they sometimes set their nets especially for the "chinees"

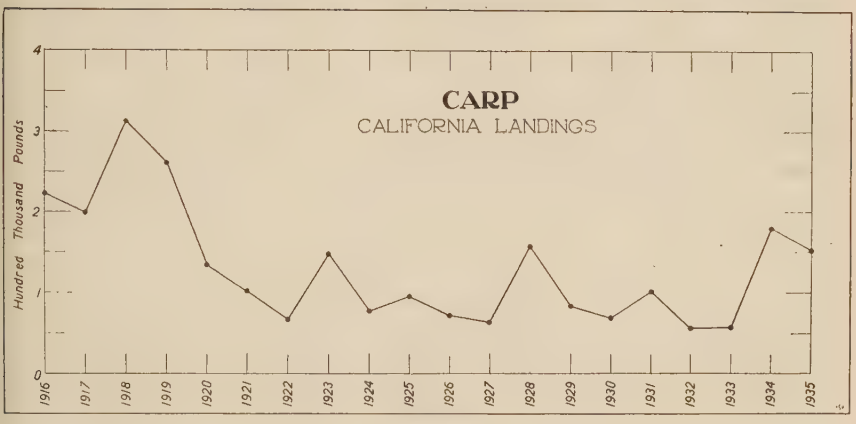

Fig. 52.

when the market warrants it. Rough fish are also taken in baited hoop lift nets operated from wharves and floats. They sometimes become entangled in gill nets set for shad and striped bass.[1]

Numbers of rough fish are sold directly by the fishermen to Oriental farm workers; many of these sales do not show in our catch records. Sport fishermen catch all of the larger varieties of rough fish on hook and line, usually while fishing for bass or catfish. The Sacramento pike is considered by many as a real game fish on account of its size and fighting ability.

The river fishermen earn a good proportion of their income by catching and selling live bait. With minnow traps they catch great numbers of young fish of various species, including young pike, hardhead and split-tail, but consisting mostly of other minnow species which are of no value as food fish. Live bait finds a ready sale among black bass anglers.

Clear Lake, although primarily important as a catfish center, has always produced small amounts of rough fish, principally carp. In

[1] See article on catfish by H. B. Nidever, pages 58-61.

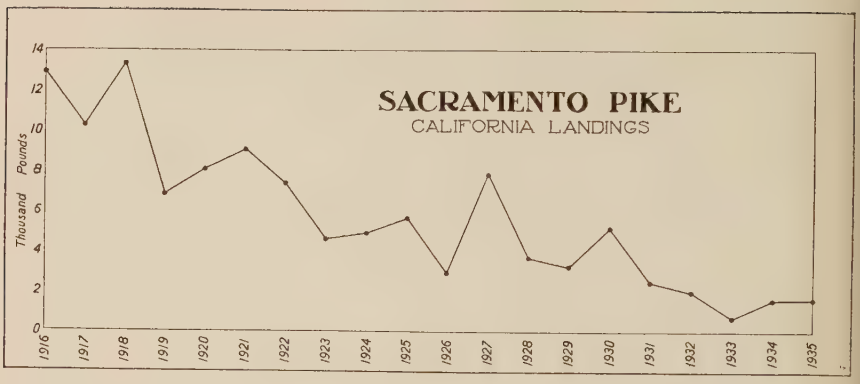

FIG. 53.

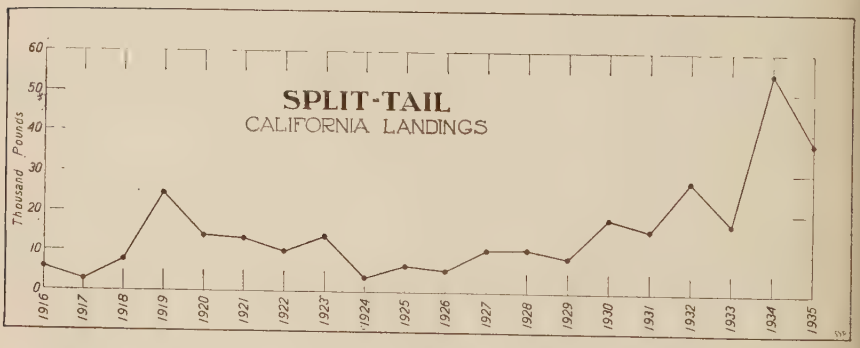

FIG. 54.

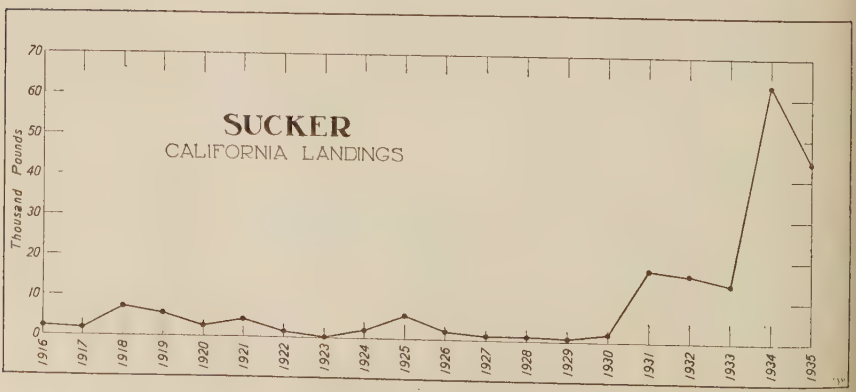

FIG. 55.

1931, the Division of Fish and Game authorized a group of fishermen to seine for rough fish in the lake. These men have operated there since then, removing tons of fish considered undesirable in the lake. They are required to release all catfish and game fish. Most of the fish caught in their beach seines are hardhead. Carp are second in volume, followed by split-tail and sucker. The Clear Lake operations are responsible for the recent increases in the catches of hardhead, split-tail and suckers. The first two years of operation showed the heaviest catches. Most of the fish taken in 1931 and 1932 were given to Indians and others for food, used for chicken feed or buried. However, considerable amounts were shipped to San Francisco markets in a truck specially designed to carry both living and refrigerated fish. Since 1932, smaller quantities have been taken, and most of the fish reaches the markets.[1]

Southern California lakes, especially Los Angeles city reservoirs, frequently contribute to the rough fish catch. Fishing is on a permit basis, permits being issued when it is considered that undesirable fish have become too abundant. The fish thus taken are mostly carp, with smaller amounts of goldfish (*Carassius auratus*). The two closely related species are lumped together as carp in the reports. Fishing is done with beach seines. Because of the nature of the fishery, catches vary greatly from year to year. The 1935 catch of carp in southern California was 48,000 pounds. Some of the carp reach Los Angeles markets, but most of them are used for fertilizer or buried. After all, the primary object is removing the fish from the lakes, and what can be sold is just that much extra for the fishermen.—*Richard S. Croker.*

Reference (see page 164): 52.

BARRACUDA

In poundage and value, barracuda ranks among the leading fish in the fresh fish trade of California. It is highly esteemed as a game fish, the sport catch comparing favorably in size with commercial landings. The entire commercial catch is sold fresh, except for a small amount which is smoked.

California barracuda (*Sphyraena argentea*) are caught in quantities from Point Conception, California, to Cape San Lucas, Lower California. The fish are usually found near shore or on shallow banks off the coast. They are taken commercially by purse seines, ring nets, gill nets, live bait boats and by trolling. Sportsmen, fishing with live bait or trolling with artificial lures, catch barracuda from the many fishing piers along the southern California coast, from the pleasure boats and barges.

When fish are plentiful in local waters the commercial boats confine their fishing operations to these areas and do not travel to the more distant grounds off the coast of Mexico. In 1935 approximately one-fourth of the total state landings came from Mexican waters.

The yearly landings have fluctuated greatly over the time interval covered by our records. (See Fig. 56.) The increase in the catch from 1916 to 1920 undoubtedly resulted from the impetus given to all

[1] The Clear Lake operators are required to make daily reports of their operations; however, in 1931 they merely made one report of their entire season's catch, detailing disposal of fish but not segregating species. For the purposes of the accompanying graphs we have divided their 1931 catch into species, using the same proportions of each species disposed of in the various ways as actually reported in 1932.

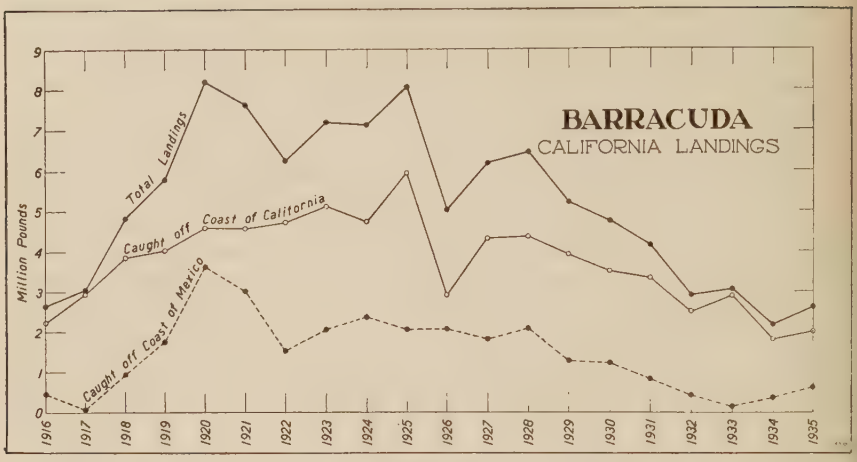

FIG. 56.

fisheries during the World War. Because of the value of the species as a market fish, the catch did not decrease with the close of the war as did that for many other species. The fluctuations between 1920 and 1925 were caused by variations in the amounts imported from south of the international boundary (California-Mexico), whereas the California catch increased steadily until 1925 except for a slight drop in 1924.

From 1925 until 1928 the fluctuations in catch reflected the influence of legislation. In 1926 a law was passed prohibiting the use of round haul nets in the barracuda fishery. This resulted in an appreciable drop in the 1926 landings. The succeeding increase presumably was caused by the stimulus given to the gill net, live bait and troll fishery as a result of the round haul net restriction.

Since 1928 changes have been made in the laws regulating the barracuda fishery at almost every session of the State Legislature. At present (1936) all net fishing is prohibited from May 1 to August 31, and trolling and live bait boats are permitted to take barracuda throughout the entire year. The various restrictive measures enacted between 1928 and 1933 did not appear to have been responsible for the almost consistent decrease from 1928 to 1935. This drop is probably the combined result of unfavorable economic conditions, increasing competition from other species of fish, and possibly a decrease in the barracuda supply.

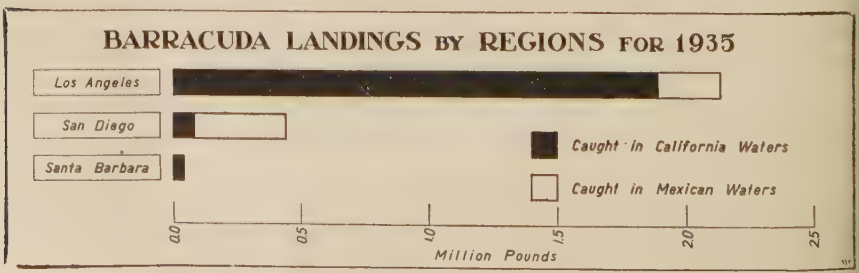

FIG. 57.

All barracuda caught south of the international boundary and delivered to California ports (see Fig. 56) are either landed at San Diego or Los Angeles, the former port receiving 59 per cent of such importations in 1935. Boats from the Los Angeles region occasionally go as far south as San Diego to make their catches, returning to Los Angeles to market their fish, consequently figure 57 shows locality of landings only and does not give a true picture of catch by water areas fished.

Only part of the local catch of barracuda is delivered cleaned, the amount varying greatly from year to year, but practically all barracuda brought from Mexican waters are delivered cleaned. Our

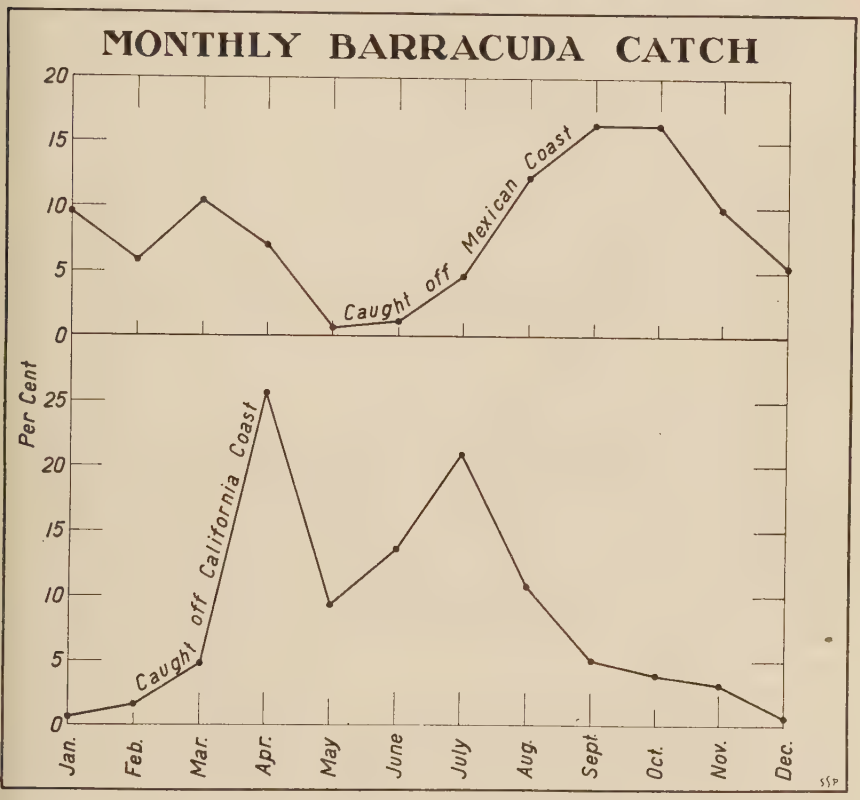

FIG. 58. Average monthly catch expressed as percentage of the average annual catch for the five-year period, 1931-1935, inclusive.

statistical records assume that all the landings given on the dealers' receipts from which they are taken are for round fish and no adjustment is made for the loss in cleaning, which in the case of barracuda is approximately 14 per cent. However, as we have no accurate record of the proportion of the catch landed cleaned and round, we must admit this discrepancy in the statistics.

The average monthly catch for the five-year period 1931–1935, expressed as percentage of the total average catch, is shown in figure 58. California and Mexican caught fish are listed separately. The May and June figures are low because of a legal restriction on the

sale of barracuda during these two months in 1934 and 1935. The heaviest California catches are made during the spring and summer months, whereas the peak of the Mexican catch occurs during the fall of the year.

The curve for fish caught in California waters roughly represents the rise and fall in the availability of barracuda on the southern California coast. (See Fig. 56.) The small landings of fish imported from Mexican waters in May, June and July, are not necessarily due to scarcity of fish during this period but more likely to the fact that the local supply is plentiful.—*John F. Janssen, Jr.*

References (see page 164): 45, 90, 100.

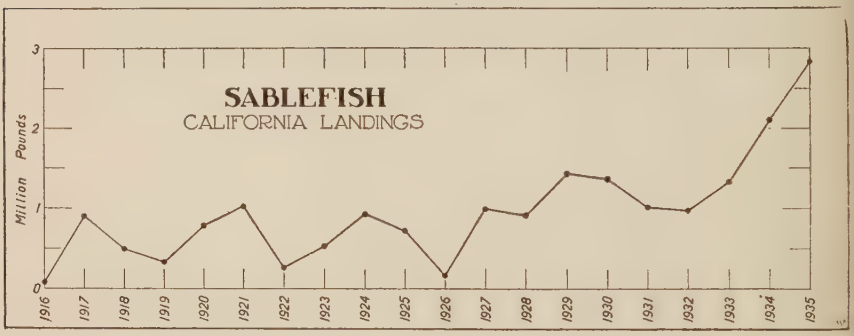

FIG. 59.

SABLEFISH

This species (*Anoplopoma fimbria*) ranked in 1935 sixteenth in commercial importance. Ranging from southern California to Alaska, it is taken throughout the year but the catch is greatest during the summer months. The greater part of the landings are sold in the fresh fish markets, but a considerable amount is smoked. Heaviest California landings are at San Francisco. This species is also called Alaska black cod, candlefish, coal cod, black cod, blue cod and deep-sea trout. Types of fishing gear are: long lines, hand lines, set lines and paranzella trawls.

The following fluctuations are apparent: a rise during the early part of the World War; a slump and another rise until 1921 when the post-war depression caused a fall in total catch; another rise until 1924 followed by a decrease in 1926. Since that time the fishery has been expanding at a great rate, halted only temporarily by the economic depression beginning in 1930.

The recent increase in catch may be explained by the fact that sablefish were formerly considered as a waste fish, not very good to eat, and only in the last few years has its value as a fine food fish come to be realized. In the Los Angeles region there has been a phenomenal rise in landings from practically nothing to a yearly total of hundreds of thousands of pounds. The demand for the smoked product is steadily increasing. The liver has been found to be of considerable value in the new medicinal oils industry, and at Eureka the fishermen have increased their efforts to land sablefish chiefly because the liver brings an even higher price than the fish itself.—*Richard B. Tibby.*

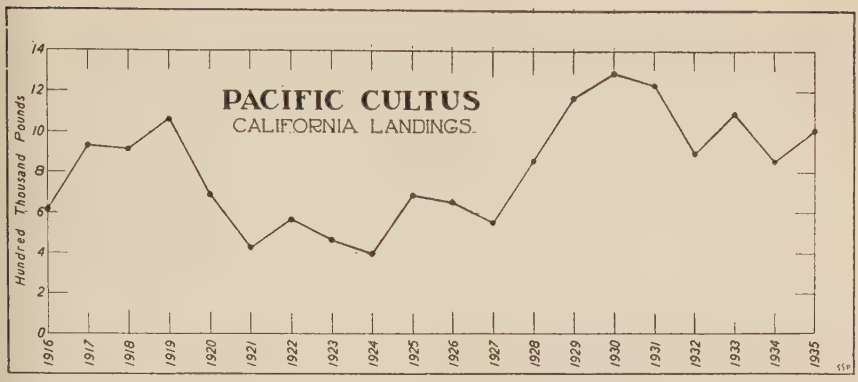

FIG. 60.

PACIFIC CULTUS

The Pacific cultus (*Ophiodon elongatus*) is of considerable economic importance in the fresh fish trade. During the earlier years of the fishery, this species was known as ling cod or simply codfish, and was confused with the Alaska cod (*Gadus macrocephalus*). Even after the difference between the cultus and the Alaska cod was made known, market men continued to call the former by the old names and so may not recognize the fish by its proper appellation.

Pacific cultus is found near shore among the rocks and it is extremely voracious. It is taken with hand lines, set lines, long lines and paranzella trawls. It is a good game fish. One outstanding peculiarity of this fish is the fact that when the flesh is cut it is a brilliant green in color but when cooked the meat is white.

The heaviest catch is from February to April and from August to October, but some is brought in throughout the year. The largest landings are in San Francisco.

The heavy catch for 1916 to 1919 is the result of the expansion of the fishery during the World War, and that period was followed by a slump during the post-war depression. The economic depression beginning in 1930 has had but little effect on the catch of the Pacific cultus.—*Richard B. Tibby.*

HAKE

The hake (*Merluccius productus*) is a fish of minor commercial

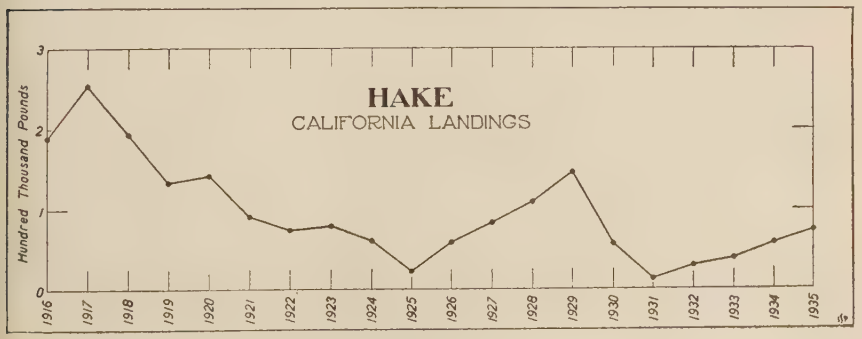

FIG. 61.

importance and its sale is confined to the fresh fish markets. It is taken with paranzella nets, hand lines and gill nets. Greatest landings are in May and August, but the fish is caught in some numbers throughout the year. Common misnomers for this species are: whitefish, haddock, melluza, meluzette and merlozzi.

Due to a confusion in nomenclature, whitefish was called "hake" in the southern counties during the earlier years. It has, therefore, been necessary to correct the earlier figures published in previous statistical reports and thus show on the above graph the true catch of hake. This was done by subtracting from the hake figures the catch of that species listed for San Luis Obispo, Los Angeles, Orange and San Diego counties for 1916 to 1919. Those catch figures were then added to the whitefish yearly totals.

The increase in catch of hake during 1916 to 1920 was due to increased demand for fish of all species as a result of the Great War, and the period of small catch in 1931 was the effect of the economic depression beginning in 1930.

The hake is described as ranging from Santa Catalina Island northward, but by far the greatest landings are made at San Francisco. This fish belongs to the same genus as the important European hake (*Merluccius merluccius*) and the so-called "whiting" of the Atlantic coast of the United States, but does not approach these relatives in economic importance.—*Richard B. Tibby.*

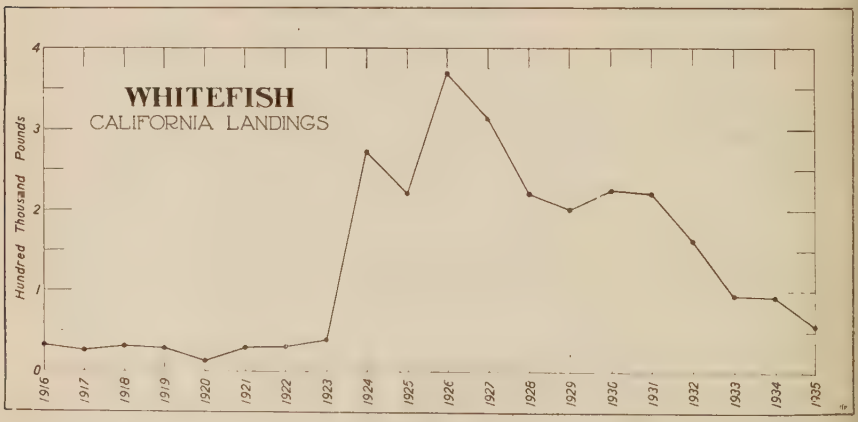

FIG. 62.

WHITEFISH

The ocean whitefish (*Caulolatilus princeps*) is of minor commercial significance and is sold entirely in the fresh fish markets. It ranges as far north as Monterey and is caught all year around, principally by rockfish fishermen on rockfish gear. From 1924 to the present time the whitefish catch curve has fluctuated in almost exact conformity with the rockfish landing record. The great rise in total catch from 1923 to 1931 was followed by a period of decrease due in part at least to the effects of the economic depression beginning in 1930.

In San Luis Obispo, Los Angeles, Orange and San Diego counties whitefish was called "hake" during the years before 1919. In order, therefore, to show the true catch of whitefish on the graph presented above, it has been necessary to revise the early figures given in the publications of the Division of Fish and Game by subtracting from the hake figures the catch listed for the above counties for the years 1916 to 1919, inclusive. Those later catch figures have been added to the whitefish yearly totals. This corrected catch record is a closer approximation to the true landings of both the whitefish and the hake than was published previously.

The whitefish is indigenous to Mexico and the lower half of California. No catches are landed north of Region 50, which includes Santa Cruz and Monterey counties. In 1935 almost 18,000 pounds or one-third of the total catch of this species were imported from Mexico.—*Richard B. Tibby.*

ALASKA COD

The fishery for Pacific or Alaska cod (*Gadus macrocephalus*) is carried on in Alaskan waters by vessels sailing from San Francisco and Puget Sound. Every spring the schooners leave port for Alaska, returning in the late summer with the catches made by their dory fishermen. The fish are cleaned and salted aboard ship and are quite dry when landed. The only codfish plant in California at present is located at Belvedere on San Francisco Bay. Here the fish are prepared for consumption in about forty styles of pack. Principal markets are in the western United States, the West Indies, Mexico, Central America and Asia.

The salt cod fishery commenced in 1863. Until 1891, San Francisco was the only Pacific coast outfitting point for codfish vessels; in

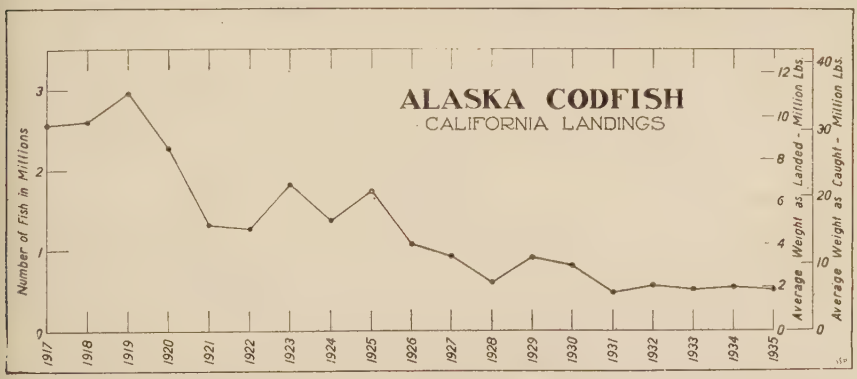

FIG. 63. Amounts of Alaska cod landed in California. The industry reckons landings by numbers of fish, as in scale at left of graph. The two scales at the right show approximate weights of fish as caught and as landed salted. Average weights vary from year to year, so the tonnage figures are not entirely accurate.

that year Puget Sound ports became a factor in the industry. The fishery expanded rapidly at first although it did not reach its peak until 1919 (we are considering California landings only). Since the time of heavy war-time demand the industry has declined. The catch in 1931 was the smallest since 1875. Reasons for the decrease are: increasing competition of canned fish, decline in purchasing power of

consumer nations and unfavorable tariff barriers. Recently, improvements in the pack have placed sales in a better position and the fishery is not expected to decline further through a lack of markets.

Because Alaska cod are landed in California in a prepared—salted—state, the amounts brought in do not appear in California fresh fish catch figures. The accompanying graph was prepared from figures gathered by the PACIFIC FISHERMAN directly from the fish companies. Codfish landings are always shown in numbers of fish. Additional scales of weights have been placed on the graph to facilitate comparisons with the other figures in this bulletin. The size of the fish varies from year to year, but the average weight as landed is about 3¾ pounds each; average weight of the fresh fish is 12 pounds. During the last few years the average weight of the salted fish has dropped to about 3¼ pounds, and the companies have had to set minimum size limits to eliminate even smaller fish.

For details of the Pacific cod fishery, see:

COBB, JOHN N.
1927. Pacific cod fisheries. U. S. Comm. Fish., Report for 1926, app. VII (doc. 1014).

CROKER, RICHARD S.
1931. Alaska codfish. Calif. Div. Fish and Game, Fish Bull., no. 30, pp. 48–55.

Pacific Fisherman Annual Statistical Numbers, Seattle.

—*Richard S. Croker.*

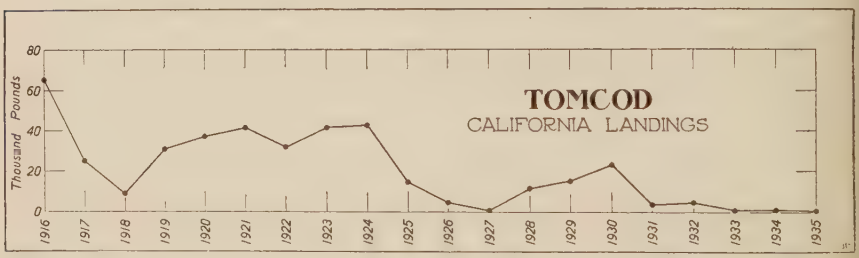

FIG. 64.

TOMCOD

The tomcod (*Microgadus proximus*) is found from Monterey to Unalaska and is the only true cod caught commercially in California. Rarely exceeding 12 inches in length, this fish is much smaller than the Alaska cod which it closely resembles in form.

Practically the entire commercial catch of tomcod is taken in the drag nets used by the San Francisco trawler boats in taking bottom fishes, and it is reported that the landings of these boats frequently included great quantities of tomcod in the days before catch records were kept. However, this species has never been of much importance in our commercial catch statistics and for the last three years has threatened to disappear from them altogether. No one definite reason for the decline in catch to its present insignificance can be given; although the use of larger meshed nets that permit these small fish to escape, and the fact that drag nets are no longer allowed in the shallow

water of the bays and within the three-mile limit, where tomcod are most abundant, have both been offered as possible explanations.

In southern California the kingfish, an entirely different species, is sometimes called tomcod.—*Dorothy Wilson.*

Reference (see page 164): 37.

WHITE SEA-BASS

The white sea-bass is one of the most valuable food and game fishes of southern California. The market catch of this species exceeds one million pounds annually, a rather large figure for a high priced non-cannery fish.

The California white sea-bass (*Cynoscion nobilis*) is a member of the weakfish family which contains many fine food fishes on both coasts of America. The commercial range of the sea-bass is from Tomales Bay in northern California to Magdalena Bay in Lower California. The slim and graceful sea-bass is one of the most beautiful of all our fishes. Its color is of burnished copper overlaid with a remarkable soft silver sheen peculiar to fishes of its family. The fish is found generally in or near kelp beds, occurring in schools and preying upon smaller fish.

In the southern part of its range, a very closely related but smaller species, the short-fin sea-bass (*Cynoscion parvipinnis*) is occasionally taken incidentally with the white sea-bass. This fish is not always separated in the catch records, and after all scarcely need be, for the

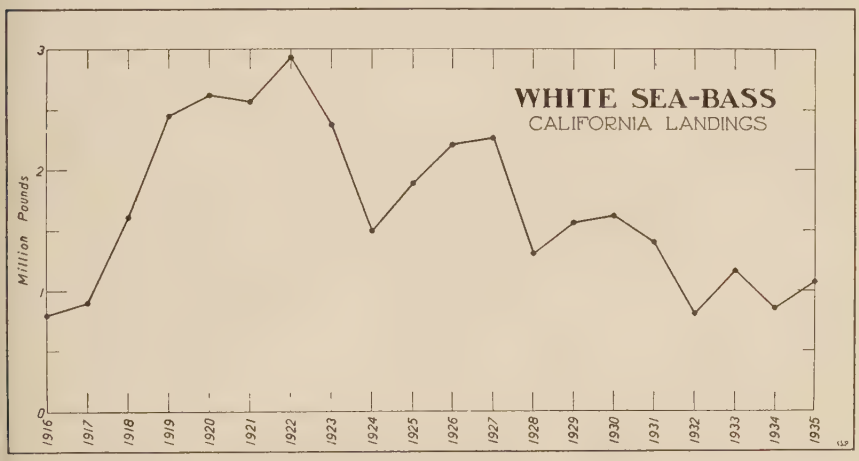

FIG. 65.

two are so much alike. Perhaps 99 per cent of the catch consists of the true white sea-bass. Small individuals of both species are sometimes erroneously called sea-trout, a name which is also applied to various similar weakfishes in the eastern and southern states.

The catch of white sea-bass reached its peak during the years 1919 to 1922, with catches exceeding 2,500,000 pounds.[1] Since 1922 there has been a decided decline in the landings. (See Fig. 65.) There

[1] **As a considerable, variable and undesignated proportion of the white sea-bass** catch is landed cleaned, the catch figures do not exactly represent the actual poundages of fish caught.

is definite proof that the supply of sea-bass has been seriously depleted. The scarcity of the fish is probably responsible in some measure for the decline in landings. The market demand has always been good and prices have remained relatively high so there has been little diminution of fishing effort. However, one entire group of boats has all but left the fishery. Some years ago there was a group of small purse seine boats that fished for barracuda and white sea-bass in

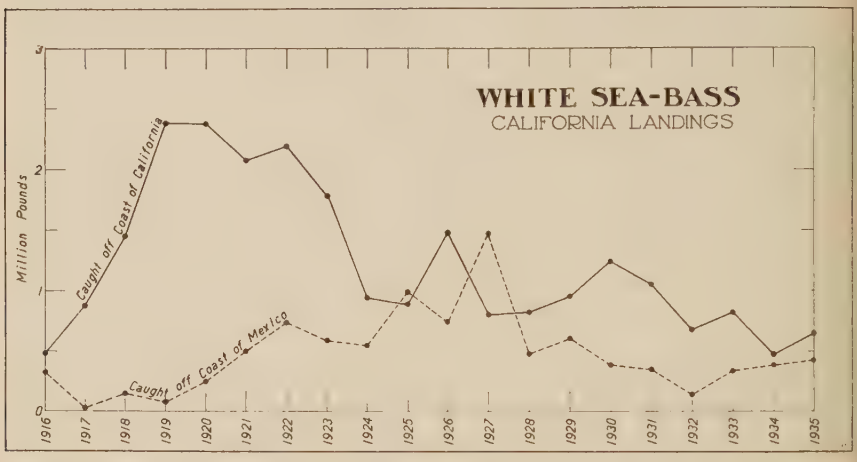

FIG. 66.

southern California waters during the summer and in Mexico during the winter. For various reasons this fleet has ceased to exist; the few surviving outmoded boats now fish for cannery species, such as sardines and mackerel. With the passing of these boats the sea-bass fishery of Lower California, as well as in local waters, has declined. Almost all other types of boat are on the continual lookout for the valuable sea-bass but in spite of the intense fishing the catch continues to decline.

During the past few years, several necessary restrictive measures governing the white sea-bass fishery have been enacted. These include closed seasons, bag limits, gear prohibitions and minimum size limits. This legislation has undoubtedly tended to curtail the catch somewhat. The laws, which were based on research, will very likely be the means of rehabilitating the depleted stock of white sea-bass in our waters.

Los Angeles Harbor and vicinity is the center of the sea-bass fishery. Approximately half the total landings are made by San Pedro boats fishing along the adjacent mainland and around the outlying islands. A considerable portion of the total catch is taken off the west coast of Lower California (see Figs. 66 and 67) and landed at Los Angeles and San Diego in roughly equal amounts. Quantities are taken locally in the neighborhood of San Diego also (see Fig. 67). Smaller but important amounts are caught off the coasts of San Luis Obispo and Santa Barbara counties and landed at Morro Bay, Avila and Santa Barbara. The catches made in Marin and San Francisco

counties are of little consequence, and the landings at Monterey and Santa Cruz are not much greater. In years past San Francisco Bay was a productive area but that was long, long ago. Occasionally small catches are made as far north as Del Norte County.

It is interesting to note that since the 1924 slump, catches in the area between San Luis Obispo and Los Angeles have remained at a fairly constant level. In the meantime, however, the fishery to the north has virtually disappeared—from a catch in 1926 of 420,000 pounds to the meager sum of 1500 pounds in 1935. During the same period, San Diego landings have declined to a marked degree. Deliveries from Mexican waters, although constant since 1930, are now considerably below those of the peak years, 1922 to 1927.

Nearly every kind of fishing gear used in California accounts for more or less white sea-bass. Prior to 1925 well over half of the total catch was made by purse seines and other round haul nets. As the fish became scarcer and large schools harder to find, the encircling nets turned to other fisheries so that at present they are of minor importance except for brief periods every spring when they catch sea-bass incidental to their barracuda fishing. Most of the sea-bass are taken at present (1936) in gill nets. Smaller quantities are caught in purse seines and round haul nets, on hand lines and pole lines with live bait, on set lines, and in trammel nets.

The white sea-bass is one of the most highly prized game fishes of California. This species, which reaches a weight of over 60 pounds, furnishes both good sport and good eating. The desperate fight of a hooked sea-bass, coupled with its tender mouth from which a hook is easily torn, makes this fish a worthy antagonist on suitably light tackle. Sportsmen catch sea-bass both large and small from piers, barges, live

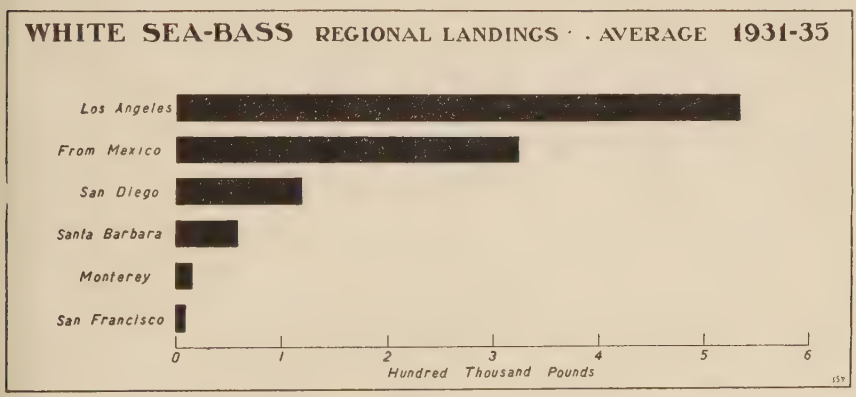

FIG. 67.

bait boats and trolling boats. Although the average size of sport-caught sea-bass runs from 5 to 25 pounds, fish of 50 pounds are relatively common. It is noteworthy that although fish of 40 to 55 pounds are frequently taken by anglers and commercial fishermen alike, very few specimens larger than 60 pounds have ever been recorded.—*Richard S. Croker.*

References (see page 164) : 50, 90, 105.

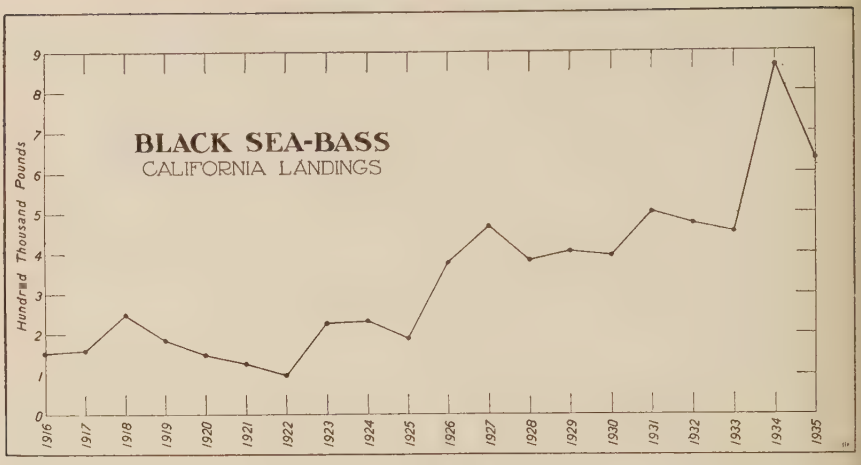

FIG. 68.

BLACK SEA-BASS

The black sea-bass (*Stereolepis gigas*) is an important market fish in southern California. This species, which is also called jewfish, giant bass and black bass, attains a weight of about 600 pounds. It is considered very highly as a game fish. Most of the black sea-bass is consumed fresh, largely as "fillets." Some, however, is dry-salted.

Largest landings are made at San Diego and Los Angeles. A few thousand pounds are landed annually in the Santa Barbara region and one or two fish a year are caught at Monterey. Most of the black sea-bass taken commercially are caught on set lines and hand lines. Sport fishermen sometimes sell them and purse seiners account for a few in an incidental way. A considerable part of the catch consists of fish caught in Mexican waters. Most of this amount is taken by California fishermen off the west coast of Lower California, but a few pounds are caught by Mexicans in the Gulf of California and shipped

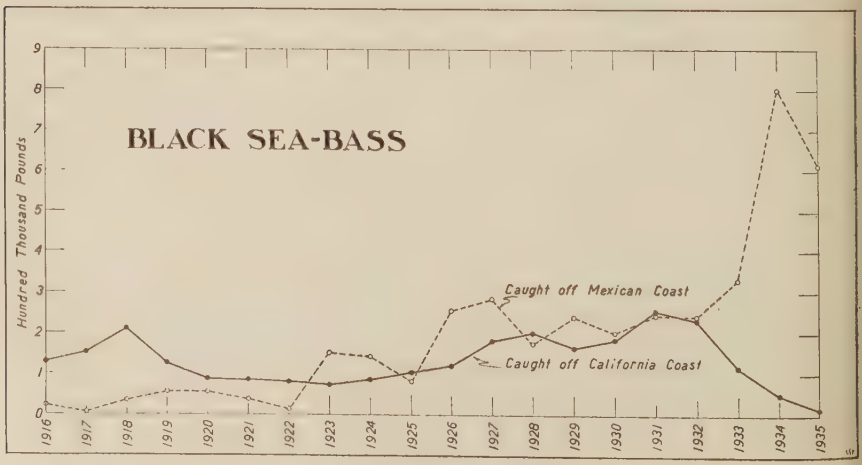

FIG. 69.

to Los Angeles by refrigerated truck as a side issue to the totuava fishery.

The catch has shown a large increase since 1922, reaching a peak of over 860,000 pounds in 1934. Roughly speaking, the fishery can be divided into three periods, as follows: During the first period, prior to 1923, it was a local fishery with an average annual catch of 126,000 pounds (1916–1922, inclusive), supplemented by Mexican landings averaging 34,000 pounds. At the start of the second period, which extended from 1923 to 1932, the Mexican catch increased until it was a little larger than the local fishery; then both catches showed a slow growth until the close of the period. During these years the local landings averaged 161,000 pounds and the Mexican 204,000. The three years following 1932 witnessed a remarkable change in the fishery. Mexican landings at both San Diego and Los Angeles increased tremendously whereas local catches at both points dwindled to practically nothing. The three-year averages for local fish were 64,000 pounds and for Mexico 585,000 pounds. The fishery can now be considered as almost entirely conducted in foreign waters.

During recent years (1932–1935) nearly all black sea-bass has been sold by the fishermen in a cleaned condition. Most of the local fish are landed eviscerated, and most of the Mexican fish have been eviscerated and beheaded. A reasonably accurate approximation of the amounts of round fish caught commercially can be reached by adding 15 per cent (cleaning loss) to the local catch figures and 40 per cent (cleaning and beheading loss) to the Mexican totals.—*Richard S. Croker.*

TOTUAVA AND CORBINA

One of the newest and most spectacular fisheries in western America is the capture of totuava in the Gulf of California and their shipment across the desert to the United States markets.

Totuava, or Mexican sea-bass, had been caught in the gulf for many years for local consumption, and for their air bladders which are prized by Chinese epicures as soup stock, but it was not until the winter of 1924–25 that shipments were made to the United States. Since that time the fishery has expanded, so that now a million pounds annually are imported into California with a like quantity going to Arizona and mid-western states.

The totuava (*Cynoscion macdonaldi*) is a member of the weakfish family, closely related to the California white sea-bass. It attains a weight of over 100 pounds and is a fine flavored "fillet" fish. It is caught by Mexican and Indian fishermen on hand lines. Recently gill nets have been introduced into the fishery. The fish are landed at several desolate little fishing villages near the head of the gulf. There they are loaded into small refrigerator trucks for the 150-mile trip across scorching desert sands to the United States border. At the border towns of Calexico and Yuma the fish are often trans-shipped to larger trucks for the run to San Pedro, although some of the Mexican trucks make the entire trip all the way to market. Some of the fish from the Sonora side of the gulf is shipped by rail. Originally, all the totuava was hauled to California markets, but during the last few seasons increasing amounts have been sent to Phoenix, Kansas City, St. Louis and other inland cities.

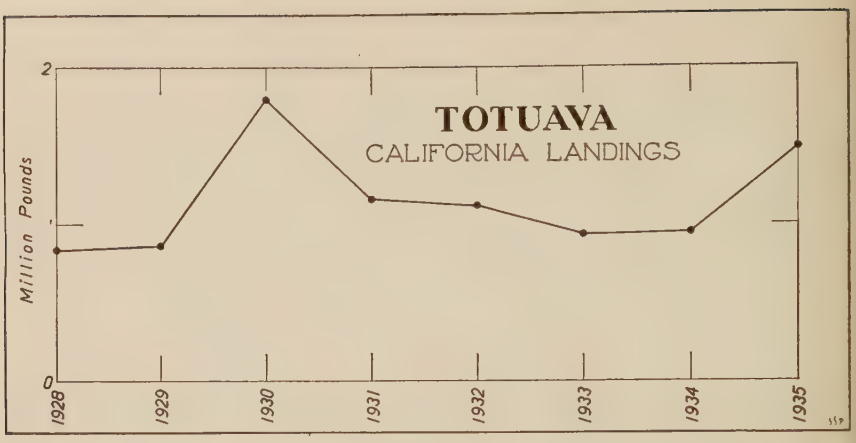

FIG. 70.

Our records (see Fig. 70) show only amounts coming into California. Nearly all of this is delivered at San Pedro and Los Angeles, although small quantities go to San Diego. As the totuava competes with California-caught fish, principally white sea-bass, its sale has hurt the local fishermen's market. On the other hand it has relieved to some extent the strain on our own fish and may indirectly postpone depletion of the sea-bass.

The totuava season extends from October to May. The weather is cooler at that time and spoilage is less apt to occur during the extended trip across the Imperial Valley. Also, the winter is the season when the fish seem to be farthest north in the gulf and consequently closer to market. Furthermore, summer fishing is prohibited by Mexican law.

Taken incidentally by totuava fishermen are several species of corbina, closely related to the totuava but smaller. The most important of these is the Gulf corbina (*Cynoscion othonopterus*). The corbina catch averages about one-tenth the totuava catch and its fluctuations

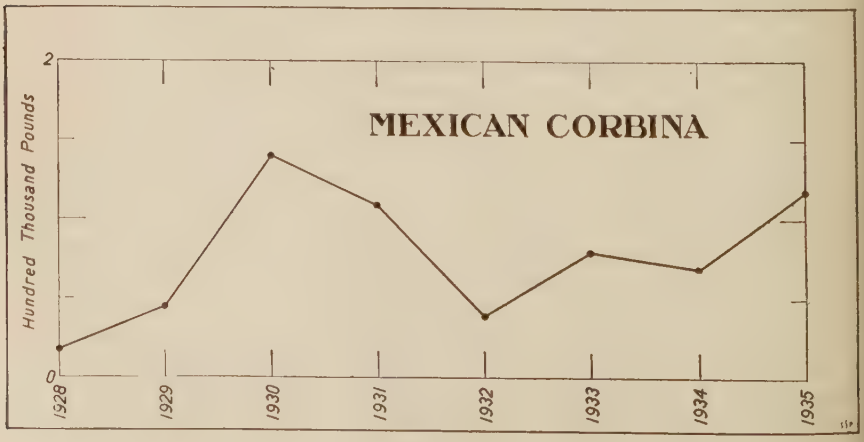

FIG. 71.

parallel the latter (see Fig. 71). The corbina is a good food fish and is also sold in the markets as "white sea-bass."

Large totuava arrive in the California markets cleaned and beheaded. Corbina and small totuava are delivered cleaned but with heads on. The air bladders of the large totuava are removed at the fish camps. There they are dried for shipment to China. Ten years ago the air bladders were more valuable than the fish themselves, but owing to chaotic conditions in the Orient, prices have dropped so that now the fishery is conducted principally for the sake of the fish.—*Richard S. Croker.*

References (see page 164): 14, 16, 50.

CABRILLA AND GROUPER

Cabrilla and grouper are bass-like fishes, and are among the most numerous inhabitants of the rocky shoreline along the west coast of Mexico. Owing to their large size and delicious flavor, they are excellent for making into fancy fillets and as such are in good demand. A great number of fishes of the sea-bass family are known as cabrilla and grouper in Mexico, and most of them are included in the catches brought to California. The most important cabrilla is *Epinephelus analogus;* the leading grouper, *Mycteroperca jordani.* Market men are not particular in their nomenclature and as a consequence the catch records can not be separated. Moreover, these similar fishes are caught together and for all purposes their capture can be considered as constituting one fishery.

Although cabrilla and grouper have been important in the fish trade of Mexican seaport towns for many years, it was not until about 1927 that they entered into the landings of the California boats that fish in Mexican waters. Since that time there has been an expansion in the fishery for market species along the Lower California coast, and cabrilla and grouper have shared in the increased catches. At first the markets were hesitant to accept the unfamiliar fish because they feared the consumer would not buy fish with such exotic names. Consequently they coined the name "golden bass," which met with immediate approval. At present these really fine fish are sold as golden bass or sea-bass fillets.

The fishery, which is conducted entirely in the winter when local species are scarce, underwent a remarkable growth during the 1928–1929 and 1929–1930 seasons and was in a fair way to becoming one of our leading fisheries. In the following years of economic depression, however, the market for higher priced fish collapsed; prices fell and the fishermen found it no longer profitable to make the long trip down to Mexican waters. Consequently the catch has declined somewhat from its 1930 peak of half a million pounds. (See Fig. 72.)

Roughly two-thirds of the California landings of cabrilla and grouper are made at Los Angeles Harbor, the remainder at San Diego. Almost the entire catch is made off the west coast of Lower California, but small amounts are taken in the Gulf of California. (See Fig. 73.) The gulf catches are made by Mexican fishermen engaged in the totuava fishery, and are brought into California by truck or rail.[1]

[1] See article on totuava, pp. 77–79.

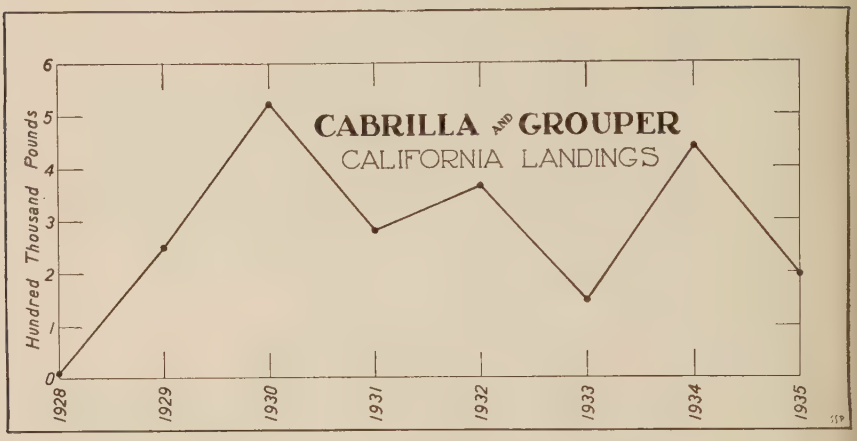

FIG. 72.

Both cabrilla and grouper are taken almost altogether by hand lines and set lines, although occasional catches are made by gill nets, trammel nets and purse seines. The best fishing grounds—or at least the most frequented ones—on the Lower California coast lie between Turtle Bay and Magdalena Bay. These fish are caught in association with black sea-bass. Fishing is carried on principally by two types of boats. One of these, the San Diego live bait boat, has long engaged in general fishing in Mexican waters, and when the demand warranted merely added cabrilla and grouper to its repertory of yellowtail, barracuda, black sea-bass, rock bass and other species. The second type of boat is the Seattle halibut vessel. The Seattle boats come south at the close of the northern halibut season in the fall and fish in Mexican waters until spring. On the way south they fish off Washington and Oregon, delivering their catches at San Francisco or Los Angeles. The pioneer in this southward movement came to California in the fall of 1934. The venture must have been successful because he returned for the 1935-1936 season, accompanied by three other Seattle boats. A few

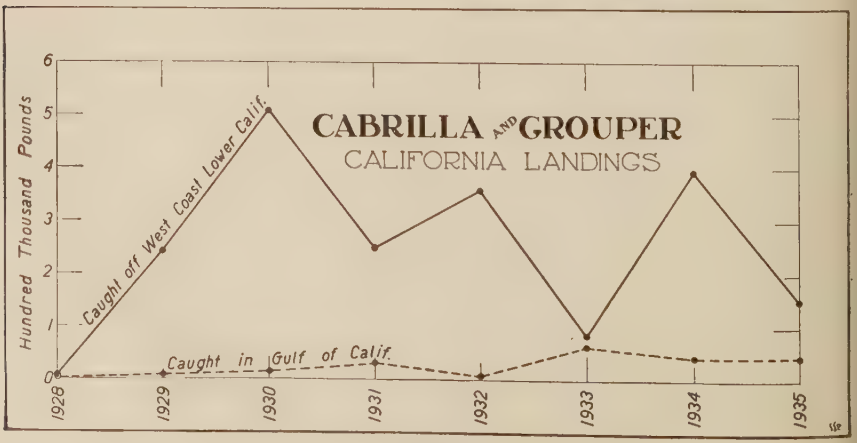

FIG. 73.

Los Angeles boats also make occasional catches of grouper and cabrilla. All the boats land their catches at either San Diego or Los Angeles—wherever the price happens to be better, which is generally Los Angeles. Sometimes as much as possible is sold at San Diego and the remainder brought on to Los Angeles for disposal in the larger market.

All cabrilla and grouper are delivered cleaned, and in addition the larger individuals are beheaded. Consequently, the actual live weight of the fish is 20 to 30 per cent greater than the landed weight as shown in the catch records.

Sport fishermen who angle in Mexican waters encounter no difficulty in catching their fill of the abundant cabrilla and grouper. In fact they find it virtually impossible to catch anything else along the rocky shores inhabited by these voracious and unwary fish that will strike at any moving object smaller than themselves. The game qualities of these fish do not compare with their table qualities, as when one is hooked it merely makes one hard dash for the nearest rock, around which it firmly wraps the line. However, when hooked in open water it gives a creditable account of itself.—*Richard S. Croker.*

Reference (see page 164): 99.

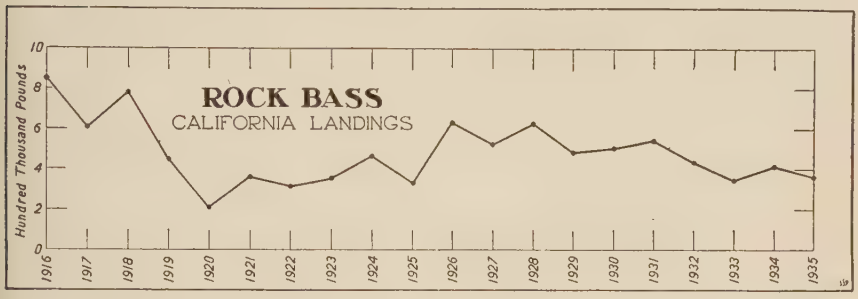

FIG. 74.

ROCK BASS

The California rock bass fishery is one of the several minor fisheries of the state whose total landings have not varied greatly from year to year. Because rock bass are, as a rule, taken only incidentally by boats fishing for other species, the fluctuations that do occur in the total landings largely result from variations in the catch of other species, especially rockfish, sheepshead and lobsters. These fluctuations, therefore, do not reflect changes in the availability of rock bass or in the intensity of fishing for these fish but rather changes in availability and fishing intensity for other species. The maximum catch in 1916–1918 (see Fig. 74) undoubtedly was caused by the impetus given to all commercial fishing during the World War, the drop to 1920 is associated with less favorable marketing conditions, and the gradual increase to 1926–1928 resulted from the expansion of the fishery during the boom years preceding the crash of 1929. The downward trend from 1928 to 1935 is perhaps caused in part by unfavorable economic conditions and probably also by changes in the intensity of fishing for other species with which the rock bass fishery is associated.

Two species support the rock bass fishery: rock bass (*Paralabrax nebulifer*) also known as sand bass, and kelp bass (*Paralabrax cloth-*

ratus) called also rock bass and calico bass. The kelp bass is the more important of the two and furnishes 75 per cent or more of the total catch.

Rock bass are caught from Point Conception south into Mexican waters with nearly half of the catch made around the Channel Islands and in the neighborhood of Los Angeles Harbor, and about equal amounts in the environs of San Diego. Small poundages are landed at Santa Barbara each year and about 10 per cent of the total landings is imported from Mexico. Most of the California catch is taken from April to September of each year, whereas the heaviest importations from Mexico occur in the winter months.

Every conceivable type of commercial fishing gear will catch rock bass. Hand and set lines, entangling nets such as gill and trammel nets, round haul nets such as lamparas and purse seines, traps, and trawls all contribute to the rock bass fishery. Hand and set lines, however, supply over half of the catch and traps take about 20 per cent. The poundage taken in traps is especially heavy in the San Diego region. In addition to the commercial fishing boats, the pleasure boats sell a certain portion of their catches. These sales, included in the commercial catch records, constitute about 10 per cent of the total landings. Rock bass are taken by sportsmen on rod and reel, usually with live bait.—*Frances N. Clark.*

Reference (see page 164): 24.

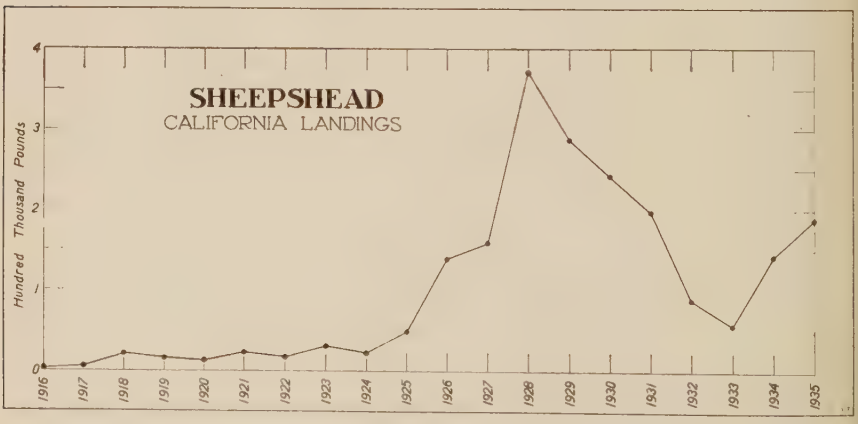

Fig. 75.

CALIFORNIA SHEEPSHEAD

The California sheepshead (*Pimelometopon pulcher*) ranges from Point Conception to the Gulf of California. It is of minor significance commercially and is sold only in the fresh fish trade. Among anglers, it ranks as one of the more important of the small sport fish caught in southern California waters, particularly around Santa Catalina Island and Point Dume.

The head of this colorful fish bears a superficial resemblance to that of the Atlantic and Gulf coast sheepshead from which it probably received its name, but to which it is not at all related. A fleshy hump on the forehead of the male, which becomes more prominent with age,

and the enormous mouth of both sexes armed with large prominent canine teeth give the fish a most pugnacious appearance. The colors of the adult fish are most striking. A broad crimson band around the male fish, just behind the head, stands out in beautiful contrast to the jet black or purple of the rest of the body. The female is usually a uniform dull red color. This remarkable appearance, especially of the male, is often the object of great interest in the window displays of restaurants specializing in fish dinners, but the menu does not mention that sheepshead is often eaten in the "lobster" salad or cocktail. As its flavor is similar to that of lobster, it is often mixed with the more expensive crustacean. The sheepshead is also used extensively in fish chowders.

Sheepshead are caught by hand or set lines, usually on the bottom near rocky shores and in the kelp. A small proportion of the catch is taken incidentally by boats fishing for rockfish, but the major part of the catch is landed by a few regular sheepshead boats. Whitefish and sharks are secondary catches made by sheepshead fishermen. The fondness of sheepshead for shellfish often leads them into lobster traps, where they can feast to their hearts' content. It is their last meal, however, because the fishermen use them as as lobster bait, as ironically enough, crustaceans are equally fond of sheepshead.

Until 1925, there was little demand for the fish and landings were light. From 1925 to 1928, the sheepshead catch rose at a surprising rate. This increase may have been due partially to the fact that many of the trolling boats fishing with set lines during the off season for albacore, did more set line fishing than previously, after the disappearance of albacore in 1926.

Sheepshead are landed commercially from Santa Barbara south to San Diego, with the greatest landings at Los Angeles. Due to small demand the local catch is sufficient to supply the market, consequently only an insignificant amount is brought in from Mexican waters.—*John F. Janssen, Jr.*

SWORDFISH

The swordfish of southern California are probably two of the most widely known fish that frequent the ocean waters with the exception of the tunas. The large size, unusual physical characteristics, including the sword, and the tremendous strength and vitality of the swordfish undoubtedly account for this recognition.

The broadbill swordfish (*Xiphias gladius*) is the true swordfish of the two species commonly referred to as swordfish in California and this same fish is found in most of the oceans of the world. The broadbill is metallic purplish on the back with no outstanding markings, shading off to a silvery gray on the ventral side. The upper jaw is prolonged into a strong, flattened, sharp-edged sword, which attains a length of some three feet. Its body is shorter and more rounded than that of the marlin. The flesh, being light colored and fine textured, resembles young pork. Some specimens attain a weight of over a thousand pounds.

The marlin (*Makaira mitsukurii*) is one of the near relatives of the true swordfish but is a member of the sailfish family. It is taken in the coastal waters of California south of Point Conception and farther south along the west coast of Mexico. It is also said to be found

in the waters adjacent to the Hawaiian Islands and Japan. The marlin has a more rounded "spike-like" sword. It is purplish blue crossed with light blue stripes on the back and shades into a silvery color on the sides. Its body is longer, much deeper, and less rounded than that of the broadbill. The flesh is much darker than the broadbill, and this difference in color seems to have a great deal to do with the preference of the public for broadbill. The marlin does not attain much more than a third the weight of the broadbill.

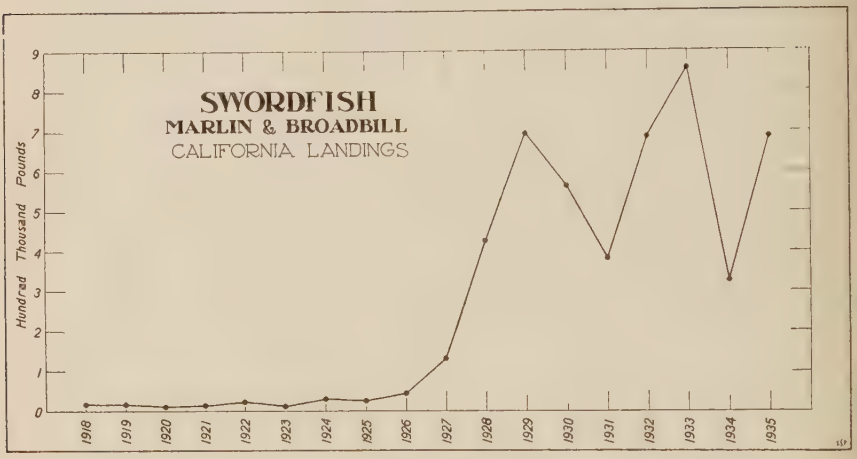

FIG. 76.

Broadbill is the standard commercial fish and it is the broadbill for which the commercial fishermen outfit. Marlin is taken only incidentally by commercial boats when fishing for broadbill. The commercial swordfish fisherman is a "harpooner," that is, his boat is equipped for spearing or harpooning, which is the chief means of catching these fish.

The boats engaged in this fishery range from 30 to 60 feet in length and usually carry two or three fishermen. They are equipped with a swordfish plank, which has a harpooning pulpit on its outer end. This plank is a sturdy narrow beam, some 20 to 30 feet long, which is fastened securely to the bow of the boat and extends out over the water. The pulpit is a small platform around which is a safety guard rail to allow the harpooner to brace himself when harpooning. The boat is also equipped with a lookout platform, high up on the mast for use in finding the fish. The fish are located by the appearance of the dorsal fin above the surface of the water, which can only be seen when the sea is smooth and glassy. Thus fishing is confined to the best of weather and a comparatively few hours each day during the season. After the fish are located, the harpooner takes his place on the pulpit and the boat is piloted so that the harpooner is directly over the fish. The harpoon barb is affixed to the end of a long pole in such a way that it will be free from the pole after it has been imbedded in the fish with a husky jab. The barb is securely attached to a long piece of quarter-inch line, the other end of which is coiled around and firmly attached to a medium sized keg on the boat. After the harpoon barb has been imbedded, the keg is thrown overboard and the fish is allowed

to play itself out before an attempt is made to land it. One or two skiffs are part of the equipment of the boat and one man is dispatched in the skiff to assist in playing out the fish until it can be brought close enough to be bled by thrusting a knife in the gills. It usually takes from one to three hours to land a fish after it has been harpooned, depending upon the size and vitality of the particular individual.

When the fish are running close to port so that the catch can be marketed daily, the boats do not carry ice, but if the fishing grounds are distant ice is necessary so that the boats can stay out "among them" longer. Some of the local trips are of a week or ten days' duration and those into Mexican waters are of necessity even longer. The flesh of the swordfish is firm and if the fish are properly cleaned, the meat will remain in good condition for a considerable length of time.

The fish usually make their first appearance off the coast of Lower California in the vicinity of Cape Colnett, some 150 miles south of San Diego, and later they appear northward in California waters.

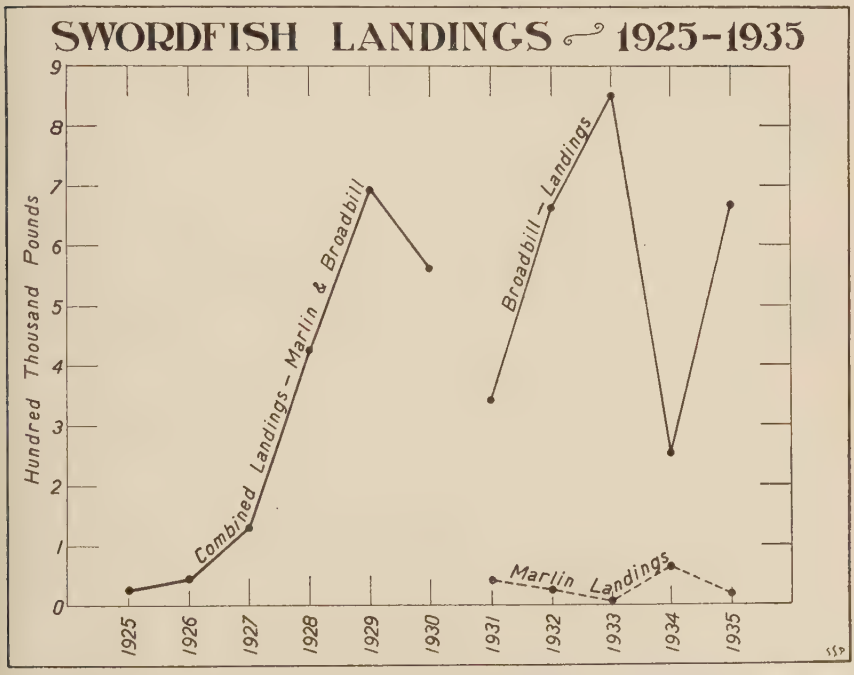

FIG. 77. Prior to 1931, marlin and broadbill were recorded as swordfish. Since 1931, a separation of the two species has been made.

The fish are taken from May to December but the largest local catches are usually made during the months of July and August.

For many years swordfish were not considered seriously by commercial fishermen. Practically the only swordfish used commercially were marlin taken by sport fishermen, who found it impractical to dispose of their catch noncommercially without waste.

The year 1927 marks the first sizeable catch of swordfish, when some 65 tons were delivered for commercial use. The recorded catch

previous to this had not exceeded 23 tons in any one year and the landings from 1918 to 1925 ranged between 6 and 16 tons yearly. This latent development of the fishery was due in a large part to the fact that markets were not willing to pay a per pound price which warranted the investment and effort in developing a new fishery. This 1927 catch and the rapid increase in deliveries for the next few years were undoubtedly due to marketing arrangements of certain wholesale fish markets. The fish were expressed to Boston and other eastern cities where the delicious quality of the meat had been known for years. The eastern shipment of a large proportion of broadbill landings continued for several years, but during this period a local California market demand was created.

In 1933, a law was passed which prohibited the shipment of marlin out of the state. At this time the marketmen showed very little concern over such a law, partly because it only affected marlin (which is of minor commercial importance) but also because the local market had developed to such an extent that frozen broadbill swordfish from Japan was being imported to supplement our local supply. Exact figures on this importation are not available, but it has assumed large proportions.

The first few broadbill of the season usually command "fancy" prices—slightly over 20 cents a pound. As the fish become more plentiful the price drops to about 9 cents and remains at this level most of the season. The fish are marketed dressed, with heads and tails off.

The broadbill freezes very satisfactorily and a portion of our local catch is put in storage during the height of the run so that the off-season demand may be met. Most of the freezing is done by the San Diego markets as the fish are usually a cent to two cents a pound cheaper there than elsewhere. At the present time, most of the swordfish is used in western markets and very little if any is shipped east.

Fresh marlin does not command the price of the broadbill and usually markets for several cents a pound under broadbill. During the last two years, marlin has found favor as a smoked fish and a great number are utilized in this manner.

In addition to the 1933 legislation prohibiting the shipment of marlin out of the state further protection was given it in 1935, when it became illegal to harpoon this species. The new law provides that it may be taken only with hook and line. This same section of the Fish and Game Code includes a provision that broadbill may be taken with harpoon as well as hook and line.

The "harpoon" fishery for swordfish is very unique in that the cost of outfitting is small compared to the potential returns possible. It is also individual in that there is little expense for replacement of gear as compared with other types of fishing. Some of the boats have been quite successful, whereas others have not found this means of livelihood so lucrative. As in any enterprise, skill and aggressiveness of the captain and crew decide the success or failure of the operations.—*L. G. Van Vorhis.*

Reference (see page 164): 59.

SHARK AND SKATE

The fish-eating public in California is unfortunately prejudiced against the use of sharks and skates as food and is not familiar with their good qualities, which are comparable with many of the better known and more expensive fishes. Great Britain, Norway, Sweden and the countries bordering on the Mediterranean have for years utilized these food fishes, which are disdained by many in the United States. However, these fastidious persons, unknowingly have eaten and enjoyed shark served to them as "fillet of sole," white sea-bass, grayfish, or even as swordfish.

The elasmobranch fishes, which include the sharks, skates and rays, comprise a large group of widespread distribution. They can be found during any season of the year but are more abundant in tropical waters. The species of the temperate zones are the most desirable for food and it is from these waters that the principal market supply is derived. Some sharks are found near the shore, others are inhabitants of the ocean depths and others are wanderers. Sharks vary in size from a few inches to fifty feet or more. Most of our California sharks are rather small with small teeth, feeding on smaller fishes and invertebrates; and others, including the basking shark, which is the largest of California sharks, subsist on minute organisms only, which disqualifies the idea that all large sharks are scavengers. The skates, or rays as they are also called, are bottom living forms, feeding on crabs, clams and other invertebrates.

In the opinion of many, sharks are the pariahs of the ocean. They destroy food fishes, are a despair of the net fishermen because of the damage they do to fishing gear, and are the dread of the average person who believes them to be man-eaters. That some species do attack human beings can not be disputed but this is not known to occur in our waters. Skates, especially the sting rays, are destructive to clam and oyster beds. Sting rays are also a menace to bathers. Occasionally drives are initiated against elasmobranchs for the sole purpose of lessening their abundance, as for instance, ridding sloughs and bays of these unpopular forms. By creating a larger market for the edible species, their population would be decreased and their destructiveness would accordingly be lessened.

Sharks and skates are sold in fair numbers in the markets of San Pedro and to some extent in San Francisco, but in the other fishing ports of California there is only slight demand for them. Catching these fishes is purely incidental to other fishing pursuits and they are taken by any type of fishing gear. In the northern California region (Monterey to Oregon) these species are principally taken by the trawlers fishing for flatfish; quantities are caught in this manner, but only enough to supply the local daily demand is brought to port, the remainder being thrown back into the water. In southern California, sharks and skates are taken chiefly by trammel nets. Some sharks and skates are brought to southern California markets from Mexican waters. By comparison, sharks sell more readily than do skates. The principal market species of sharks are the smoothhounds, soupfin and the grayfish; and the California skate and big skate hold a prominent place among their kind. The "wings" or the pectoral fins of the

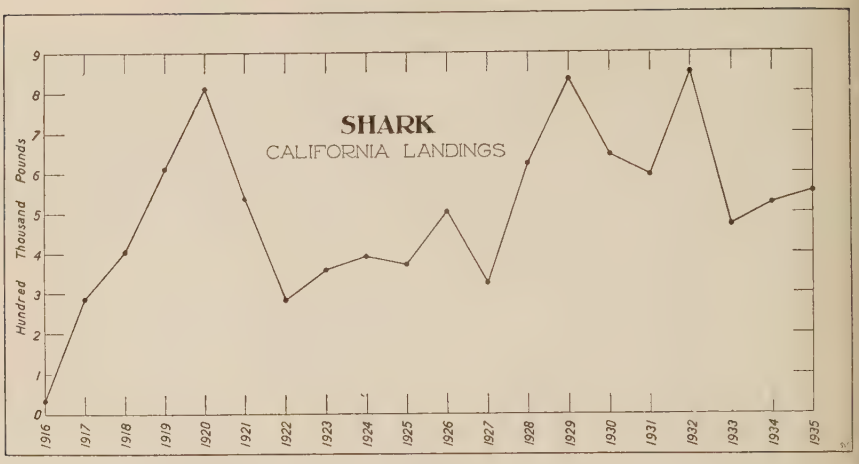

FIG. 78.

skates are the edible parts of these fish. Only very small quantities of sting rays are marketed, although some are used for manufacturing oil and meal, as is also the surplus of the shark catch. In recent years small amounts of sharks have been smoked in southern California.

During the ten-year period, 1926–1935, the annual average shark catch amounted to slightly more than a half million pounds, and the average annual skate (including those species called rays) catch was almost 300,000 pounds. (See Figs. 78 and 79.) In the earlier published records of the Division of Fish and Game, all species of sharks were listed as grayfish.

Besides being used for human consumption, sharks are exploited for other purposes. Oil is extracted from the liver of sharks and this product has a medicinal value comparable to cod-liver oil although some species produce oil of a higher vitamin content than others. Shark oil is also used for dressing leather and manufacturing soaps and paints. Formerly shark skin was used only for abrasive purposes and for sword hilts, but with the recent development of a process for removing from the skins the deeply imbedded calcareous scales called shagreen, a new field of producing durable leather from shark skins has been created. The principal source of this supply is in the Gulf of Mexico, the Carribbean Sea and the West Indies, where large sharks are prevalent. Gill nets and long lines are used in this fishery.

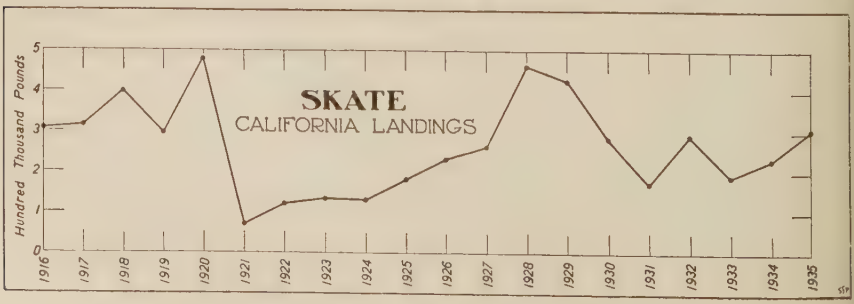

FIG. 79.

Another shark by-product, which brings a good price among Orientals, especially the Chinese, are the shark fins that are used in making the well-known shark fin soup. Soup fins are produced in California for domestic and Asiatic markets.—*Katherine Karmelich.*

References (see page 164): 15, 101.

SMELT AND WHITEBAIT

The smelts of California supply one of the more important of the minor fisheries of the state. The yearly catch records, given in figure 80, show no distinct fluctuations nor definite trends. The higher poundages in 1916 and 1917 suggest the development of the fishery during the World War, and the immediately succeeding drop shows the influence of the post-war depression. The general increase from 1924 to 1931 may have been brought about by the prosperous era of the

FIG. 80.

later twenties, and again the depression of the early thirties may have caused the decrease in the catch after 1931. The whitebait landings follow a somewhat similar trend.

Aside from a general reflection of economic conditions, the catch figures for smelt and whitebait have little meaning. This is due to the many complexities involved in the statistical records. The cause of these complexities is that several species from two different families of fishes are marketed as smelt in California. These are the silversides, comprising the jack smelt, bay smelt and grunion, and the true smelts, including the surf smelt or day fish and the night fish. The problem is further involved because night fish, although at times sold as smelt, are usually marketed as whitebait. In addition, the name whitebait is applied to the young of almost any species of fish. The smelt catch record as shown in figure 80 includes, therefore, the catches of jack smelt, bay smelt, grunion, surf smelt and some night fish. The record for whitebait shows the major part of the catch of

night fish and small poundages of the young of many other species. Because of this interrelation between the catch records for smelt and for whitebait, the poundages for each classification are here shown on the one graph and the fisheries for the two groups discussed together.

The heaviest catches of smelt and practically all the whitebait landings are made in San Francisco Bay and to the northward. In the San Francisco region about 80 per cent of the smelt catch is composed of equal quantities of jack smelt (*Atherinopsis californiensis*) and of bay smelt (*Atherinops affinis*). The remaining 20 per cent is chiefly surf smelt (*Hypomesus pretiosus*), with some night fish (*Allosmerus attenuatus*), and *Spirinchus starksi*. The whitebait catch consists mostly of night fish but also includes small quantities of the young of many different species. Off Eureka and Crescent City some jack and bay smelt are taken but most of the smelt and whitebait catches are made up of surf smelt and night fish.

At Monterey small amounts of whitebait are taken and the smelt catch consists of about 80 per cent jack smelt, 10 per cent bay smelt and 10 per cent surf smelt. South of Monterey no true smelt are found, consequently no whitebait is delivered. The southern California smelt catch is composed of jack smelt, bay smelt and grunion (*Leuresthes tenuis*). Jack smelt makes up 75 per cent or more of the total and the remaining poundage is divided about equally between bay smelt and grunion.

For the entire state, the recorded smelt catch consists of approximately 70 per cent jack smelt, 15 per cent bay smelt, 13 per cent surf smelt and night fish, and 2 per cent grunion. The confusion in the records makes impossible an accurate separation of the surf smelt and night fish. The recorded catch for whitebait consists very largely of night fish. A distinction is made between the recorded smelt catch and the total smelt catch. This is done because considerable poundages of surf smelt and night fish are caught by Indians and farmers living along the rugged coast of northern California. These fish are either used immediately by the families of the fishermen, preserved for the winter supply, or peddled out to the local trade. We have no record for much of this catch but it is sufficient to materially augment the quantities of true smelt taken from California waters.

The various methods of catching smelt and whitebait are probably the most picturesque among all our California fisheries. North of San Francisco the true smelts are taken in dip nets and in small hand seines operated in the surf. When the smelts are running, the fishermen wade out into the surf, quickly dip their nets into the breakers and scoop up the fish. Only a few fish may be taken with one immersion of the net or the operator may be so successful he has to return to shore to empty his catch. Fishing with any given run begins soon after the turn of the high tide and lasts for an hour or two. Certain beaches are especially renowned for their run of surf smelt and night fish; notably at the mouths of Juan and Usal creeks north of Fort Bragg, the mouth of Mad River north of Eureka, the mouth of Smith River north of Crescent City, and the beaches of Halfmoon Bay. Surf smelt, known locally as day fish, are taken during the day and sold to tourists or peddled out in the small towns of the region. These fish can not be shipped successfully for any distance because they soften quickly. Consequently, they supply local markets only. Night

fish are taken at night and, because they withstand shipping, many pounds are caught and shipped to San Francisco, where as a rule they are marketed as whitebait.

In Monterey Bay, circle gill nets are used for jack and bay smelt. A school of fish is encircled with a gill net, then a scare, operated within the circle, drives the fish into the meshes of the net. Gill nets are used for jack and bay smelt in San Francisco and Tomales bays. Jack smelt are also taken in San Francisco Bay on set lines. One end of the line is tied to a pier and the other anchored out from the pier. Floats keep the line near the surface of the water. In the Monterey and San Francisco regions true smelts are taken in drift gill nets.

In the San Luis Obispo region smelts are taken in gill nets, but in southern California round haul nets constitute the chief gear of the commercial smelt fishery. In addition at Newport, thirty miles south of San Pedro, a beach seine is used for jack smelt. The fishermen locate a school of fish in the surf, pay the seine out from a skiff around the school, and pull the net onto the beach with horses. This fishery is legal from September to January only, and smelts are the only fish that may be taken in this manner.

Throughout the entire state, smelts are caught with hook and line off the piers by amateur fishermen. In some instances the lines are baited and at other times the fish are caught by snagging. For snagging, the fish are chummed into a compact school, and a line with several hooks is dropped into the center of the school and quickly jerked upward. When the fisherman is fortunate, from one to two to three fish may be snagged with a single jerk of the line. Surf smelt, jack smelt, and bay smelt are all caught in this manner. In shallow lagoons and estuaries, smelts are caught on hook and line from small boats. In this type of fishing the hooks are baited. Off Morro Bay in the San Luis Obispo region, sport fishermen troll for jack smelt with a trout spinner.

In southern California grunion are taken on the beaches during the spring and summer months. When the fish come up onto the sand to spawn, crowds of people gather on the beach and in former years caught these fish by every conceivable means. Small nets, window screens, sink strainers and many other improvised gears have been used to dip the fish out of the waves. The more agile pick the fish up with their hands. At present any apparatus for taking grunion on the beaches is illegal and fishermen must use their hands only.

Very few regulatory measures have been deemed necessary to protect the smelts of California. The grunion is afforded a needed protection through a closed season from April to June and the prohibition of the use of any type of gear to take grunion on the beaches. A minimum size limit of seven and a half inches was placed on jack smelt and of four and one-half inches on bay smelt in 1933. No other legislation referring specifically to smelts or whitebait has been enacted. —*Frances N. Clark.*

References (see page 164) : 5, 17, 18, 19, 20, 73, 96.

PERCH

The perch catch of California has shown no significant fluctuations during the time interval covered by our statistical records.

This probably results from two causes; first, the fishery is of such minor importance that it is not greatly affected by economic conditions, and second, many different species of fish are included in the records of the perch catch. These species differ widely in structure and habits and in all probability any significant changes which may have occurred in the catch of one or two species are obscured by the total landings of all species involved.

Indeed, these many species make the California perch catch an outstanding example of the confusion which arises when numerous kinds of fish masquerade under one common name. To begin with, none of the so-called perches in California belongs to the family of true perches, Percidae. Furthermore, the California perches, although they all bear a superficial resemblance to one another, include not only twenty or more different species but they are members of four different families of fishes. Of these the salt-water perch family, Embiotocidae, is the most important in the California perch fishery. It supplies the entire perch catch of northern California and the major part of the landings for the southern half of the state. Of the salt-water perches, there are nineteen species found in California waters and nearly all are occasionally taken in the commercial fishery. Five species, however, make up most of the catch.

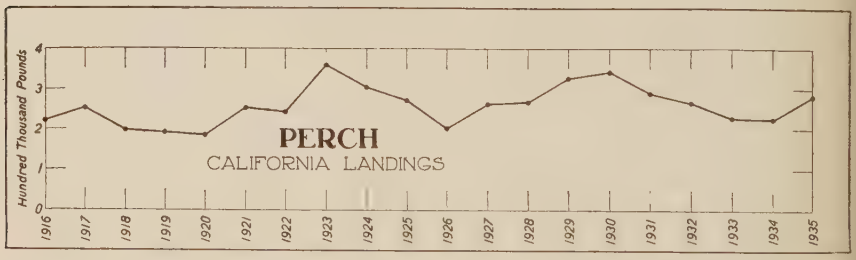

Fig. 81.

In the San Francisco region where almost half of the California perch catch is landed, the Pacific white perch (*Phanerodon furcatus*) and the rubberlip (*Racochilus toxotes*) comprise most of the poundages. These two species are taken in about equal quantities. In Monterey Bay where about 15 per cent of the state's perch fishery occurs, one-half of the catch consists of wall-eyed perch (*Hyperprosopon argenteum*) and striped perch (*Taeniotoca lateralis*), and approximately one-fourth of Pacific white perch and fork-tail perch (*Damalichthys vacca*). The remainder consists of seven or eight other species of salt-water perch of which the rubberlip is the most important. The only other region in northern California of significance in the perch fishery is Eureka. Here small catches are made which consist mainly of barred perch (*Amphistichus argenteus*).

South of Point Conception approximately one-third of the entire state's perch landings are made in the Los Angeles region. Here the salt-water perches dominate the catch but do not make up its entirety. Somewhat more than half of the landings consist of Pacific white perch and about 10 per cent are composed of wall-eyed perch. Small amounts of six or seven other species of salt-water perch are also found in the Los Angeles perch catch. In addition approximately

30 per cent of the perch taken in this region are halfmoon (*Medialuna californiensis*) which belongs to the rudderfish family. The opal-eye (*Girella nigricans*), also a member of the rudderfish family, is taken in small amounts as are two members of the demoiselle family, the blacksmith (*Chromis punctipinnis*) and the garibaldi (*Hypsypops rubicundus*). The garibaldi, bright orange in color, is known to all visitors to the various marine gardens located in southern California. Finally, one more species, the sargo (*Anisotremus davidsoni*), a member of the grunter family, is included in the southern California perch catch. The sargo is of more importance in the perch fishery of the Los Angeles region than are the opal-eye, the blacksmith, or the garibaldi.

In the remaining two regions of southern California, Santa Barbara and San Diego, perch are also taken but in very small quantities. The species involved are similar to those in the Los Angeles region.

For the entire state, the perch catch consists of about 40 per cent Pacific white perch, 25 per cent rubberlip, 10 per cent halfmoon, 5 per cent wall-eyed perch, and 15 per cent miscellaneous species of salt-water perches and other perch-like fishes.

As the species involved in the California perch catch differ between northern and southern California so also do the fishing methods. The San Francisco perch are taken chiefly in beach seines in Tomales Bay with small amounts caught in San Francisco Bay. At Eureka the perch are taken in beach seines operated in Humboldt Bay. In Monterey Bay about two-thirds of the catch is taken in lampara nets and one-third in drift gill nets. These drift gill nets are not left unattended for their success depends on frightening the fish into the net. This is done by splashing the water between the shore and the net or, if the net is set in a circle, by similar operations within the circle of the net. The scare used for this splashing is usually a brick or stone tied to a retrieving line.

In southern California practically all the salt-water perches are taken in lampara nets of the usual type, but the halfmoon is caught in nets devised especially for halfmoon fishing. Only two or three boats are engaged in this fishery. These are live bait boats which fish for other species with hook and line and supplement their catch with halfmoon. The halfmoon is taken in a small net built like a purse seine only on a miniature scale. The webbing, of 3-inch stretched mesh, is tanned and the net is approximately 100 fathoms long and 10 fathoms deep. The purse rings are much smaller in diameter than those used on the large purse seines. Most of the halfmoon are taken around San Clemente Island.—*Frances N. Clark.*

Reference (see page 164): 22.

KINGFISH

The California kingfish catch has experienced no great fluctuations over the period of years covered by our statistical records. The fishery developed during the World War to a maximum poundage in 1918, and dropped to a minimum in 1921 due to the decreased demand for fish which followed the close of the war. For the next ten years the total catch remained practically constant, but since 1932 the landings have again increased. The cause of this increase is not evident

in our statistical records, although the increase appears to be statewide and not the result of greater catches in a single locality. More favorable economic conditions might have augmented the catch somewhat but not enough to produce a greater catch in 1934 and 1935 than for any year since 1919. An increased abundance of kingfish might produce such a change, but more probably the scarcity of more desirable species created a greater demand for the formerly less sought after kingfish.

The kingfish catch is composed almost entirely of one species, *Genyonemus lineatus.* Very small amounts of queenfish, *Seriphus politus,* are also included in our catch records but the poundage is negligible. In southern California the kingfish is frequently called tomcod and the queenfish, herring. But since both the kingfish and queenfish belong to the croaker family and are neither cods nor herrings, these names are gross misnomers.

Approximately two-thirds of the state's kingfish catch is landed in the Los Angeles region. Most of the remaining third is taken in Monterey Bay. Small amounts are also caught off San Francisco and San Diego, and a few pounds are imported from Mexico each year.

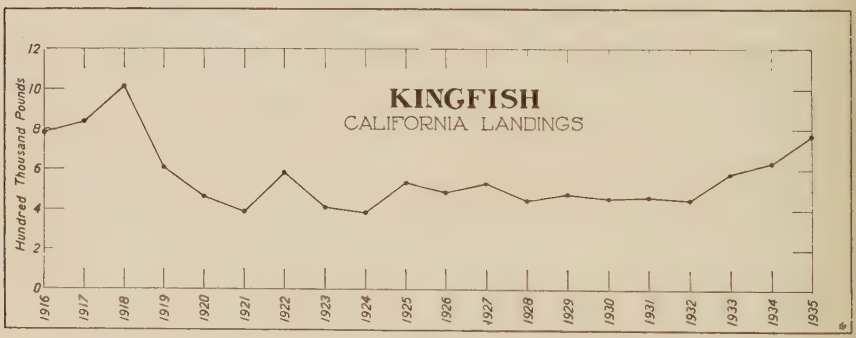

FIG. 82.

Kingfish are caught throughout the entire year but the heaviest landings occur during the winter months.

Kingfish can be taken with hook and line, gill nets and round haul nets. In Monterey Bay the bulk of the landings is caught with gill nets. These are set parallel to a sandy shore, left over night, and pulled the following morning. Small amounts are also delivered by fishermen operating lampara nets. This gear, an Italian name for a certain type of round haul net, constitutes the chief method used for catching kingfish commercially in southern California. In the Los Angeles region, hand and set line fishermen also bring in small amounts of kingfish but most of the poundage is delivered by a small number of lampara fishermen operating out of San Pedro and fishing exclusively for the fresh fish trade.

In addition to the commercial catch of kingfish here shown, many kingfish and queenfish are taken each year by amateur fishermen, especially in southern California. Although generally scorned by sport fishermen, these fishes add much to the pleasure and to the larders of hundreds of people fishing off the wharves and piers along the California coast.—*Frances N. Clark.*

Reference (see page 164): 21.

FLYING FISH

Because the flying fish and its picturesque habits have long been sung by poets, everyone is familiar with these fish—either through reading or by actual observation. The California flying fish, *Cypselurus californicus,* adds much to the pleasure of all vacationists who make the trip to Santa Catalina Island but few realize that this fish also plays a minor role in the state's commercial fishery. The role is so minor, however, that previous to 1928 the record of the flying fish catch is lost in the maze of fish statistics, and the accompanying figure 83 shows only landings for the years 1928 to 1935. We know that flying fish were used commercially in the earlier years, but the poundages were not separated from the records of miscellaneous species.

Since the catch of flying fish has been recorded separately, the fluctuations in the total have not been great. The rise from 1928 to 1930 is probably caused, in part at least, by increased accuracy in the records, whereas the drop to 1933 reflects the economic depression. All

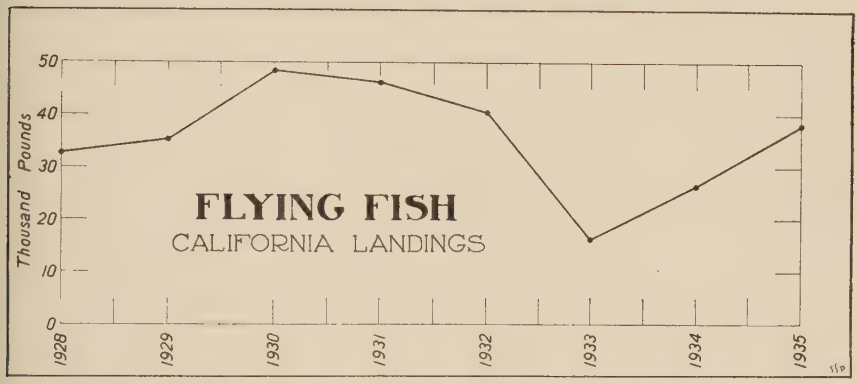

FIG. 83.

of the landings are made in the Los Angeles region during the spring, summer and fall months.

Most of the fish are caught in gill nets around the Channel Islands. They are reputed to be a favorable food fish but their chief use at present is for bait, especially in the marlin fishery.—*Frances N. Clark.*

MULLET

The mullet (*Mugil cephalus*) occurs on the Pacific coast of North America and South America from Monterey to Chile. It is a world-wide species found usually in estuaries and shallow bays. In California it is of very slight importance to the fishing industry. We have no records of any commercial quantities taken north of Los Angeles County, whereas the majority of these fish is caught near San Diego.

At the present time (1936) practically all of the mullet entering California markets are taken in the shallow waters of San Diego Bay with beach seines or circle gill nets operated as round haul nets. Mullet are seldom caught by hook and line.

This species was established in Salton Sea in 1905, at the time that area was flooded by the Colorado River. In 1915 the fish were

abundant enough to be taken from this inland sea in commercial quantities. During the next few years a market slowly developed. Expansion of this fishery was probably responsible for the increased landings from 11,000 pounds in 1916 to a peak of 91,000 in 1918. The mullet were caught in trammel nets or impounded in weirs of wire netting placed along the shallow shores. As the sea gradually became shallower due to receding waters, boats and fishing gear were operated with greater difficulty. In addition, the increasing salinity of the water was unfavorable to the existence of the species. The result was a discontinuance of the fishery in that area on a commercial scale in 1921.

In past years varying amounts of mullet have been imported from Mexico but due to the small market demand importations became insignificant in 1934 and dropped to zero in 1935. The Gulf of California was probably the source of most of the imported fish. Several fluctuations on the accompanying graph (see Fig. 84) can be traced to variations in the amount brought into this state from Mexico, especially

Fig. 84.

during the years 1923, 1928 and 1930. Other fluctuations may be due to inadequate statistics from Salton Sea.—*John F. Janssen, Jr.*

References (see page 164): 52, 95.

POMPANO

One of the finest food fishes taken in California waters for the fresh fish markets is the California pompano, which unfortunately is not caught in any great abundance. This species (*Palometa simillima*) is not a true pompano but belongs to the butterfish or harvestfish family (Stromateidae). It reaches a length of 10 inches and is found from Puget Sound to San Diego. Because of the similarity in common name and the shape of its body, it is sometimes mistaken for the true pompano (*Trachinotus carolinus*) of the gulf coast, which is also renowned as an epicurean's delight.

It is the highest priced market fish in California, the average price received by the fishermen being 33 to 53 cents per pound. There is no special fishery for the pompano because of its apparent scarcity. It is caught by boats which fish for assorted market species with round haul nets close to shore. Most of the catch now delivered to the San Pedro markets is taken by one or two boats, whose captains have an uncanny ability to locate this expensive fish. It is taken irregularly

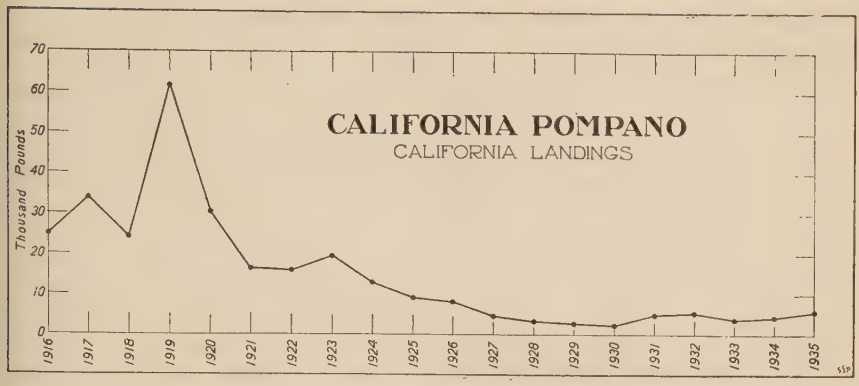

FIG. 85.

throughout the year, although the larger part of the deliveries in the past has been made during the winter and spring months.

As shown in figure 85, the California pompano was fairly abundant during the years 1916 to 1924, but since then the annual catch has dwindled to between 2000 and 9000 pounds. Los Angeles Harbor has always received the largest deliveries. Earlier records show that a few thousand pounds were marketed annually in San Francisco, Santa Cruz and Monterey, and lesser amounts in San Diego, but in more recent years the deliveries at these points have decreased to practically nothing at all. The 1935 catch of 5824 pounds was distributed between Monterey and Los Angeles, the former receiving only 239 pounds and the latter 5585.

Probably to supplement the catch of the California species and to meet the market demand for the fish called "pompano," the Mexican pompano (*Trachinotus kennedyi*, a member of the family of true pompanos) has been brought up from Mexico to Los Angeles and San Diego. According to available records, the first delivery of slightly more than 200 pounds was made to local markets in 1920. These deliveries continued sparingly at first through 1925, abruptly ceased in 1926, and were resumed the following year with approximately 50,000 pounds, the largest amount brought to California from Mexico. (See Fig. 86.) During 1928 and 1929 about 26,000 and 22,000 pounds,

FIG. 86.

respectively, were marketed in California. However, none was received in 1930, only negligible amounts from 1931 to 1934, and nothing in 1935. The increase in deliveries from Mexican waters during the years 1927 to 1929 may have been the result of concerted efforts made at that time by the California trade to create and develop a local market for various species caught below the southern limits of California.

The Mexican pompano can not compare with the California species in eating qualities as its flesh is dry and relatively flavorless, and therefore does not meet with as ready a sale in the retail markets. The average price paid to fishermen by the local markets has been 8 to 13 cents per pound.

Previous to 1929, no separation of the Mexican and California pompano was made in the published records of the state's fisheries statistics.—*Katherine Karmelich.*

References (see page 164): 64, 98.

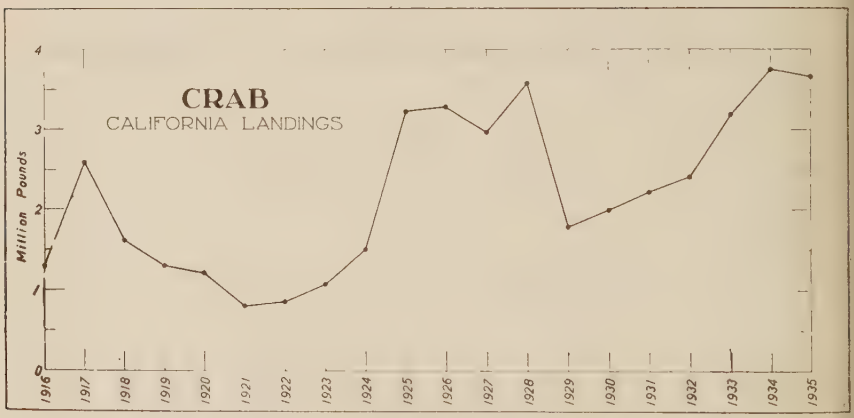

FIG. 87.

CRABS

Crabs are one of our most valuable fresh fish market products. During the period 1916–1935 the crab poundage ranked between fourth and fourteenth place but most often between fifth and tenth place on the market fish list. In the combined cannery and market fish list for the above period, the crab poundage ranked between sixth and twentieth place. The average yearly poundage has been a little less than two and a quarter million pounds.[1]

The most important crab in California is the market crab (*Cancer magister*), sometimes called white crab or Dungeness crab. The range of this species is from Alaska to Magdalena Bay; only occasional specimens are found south of Pt. Conception. This is the only crab protected in California. It is the largest, meatiest, best flavored and most abundant of our edible crabs. Up to 1936, the market crab formed over 99 per cent of the annual crab catch in California. In 1933, the increased poundage of three species of rock crabs became noticeable in the Los Angeles area.

The yearly crab catch of California for the 20-year period, 1916–1935, is given in figure 87. From an examination of the catch figures

[1] Computed on the basis of 24 pounds per dozen market crabs.

during the years 1916–1921, only, it would appear that crabs were being depleted. The deliveries fall off steadily from 1917 until a low of 800,000 pounds is reached in 1921. However, from 1922 the catch increased in general to reach an all-time high of about 3¾ million pounds in 1934, with a slight drop in 1935.

Although the yearly fluctuations may be due in part to availability, the main factor is economic conditions. Market crabs are more susceptible to economic fluctuations than are most other marine fishery products. Compared to other marine foods, crab meat is expensive and consequently something that people can do without when close budgeting is in order.

The rock crab catch in California is hardly significant when compared to that of the market crab. Previous to 1933 the deliveries never amounted to more than a few hundred pounds a year, and in some years the take was not even recorded.

South of Monterey Bay, the market crab is not abundant enough to warrant catching commercially. The commercial fishing is carried on in Monterey Bay and extends northward along the Pacific coast into Alaskan waters. It is taken over a sandy bottom for the most part, but can be caught over a clay or mud bottom at times. Along the California coast nearly the entire commercial catch during the years 1916–1935 has been made within the following areas: San Francisco, which includes the fishing area between Pt. Reyes and Halfmoon Bay; Eureka, which includes the fishing area between Eel River and Crescent City; and Monterey, which includes Monterey Bay.

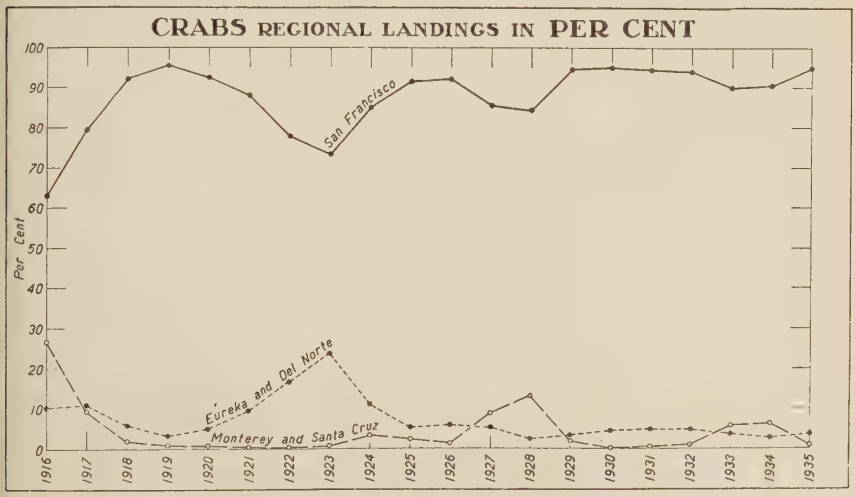

FIG. 88.

The average monthly crab catch in the three important areas during the years 1931 to 1935, inclusive, is shown in figure 89. In the San Francisco area the monthly landings follow demand rather closely. There are more than enough fishermen working in this area to satisfy the demand and this, plus the universal use of live-boxes in which several days' supply can be stored, make for a reserve that is usually above market requirements. In the Eureka area, the monthly landings also follow demand rather closely. Due to the crab export law

passed in 1917 and amended in 1923 to prevent smuggling, a limit on the amount of crabs that can be disposed of has been automatically set. In the Monterey Bay area, the monthly landings are governed principally by the available supply of legal sized crabs. Live-boxes are not practical so a reserve supply can not be kept on hand. When it is considered that Monterey Bay is the southern limit of commercial market crabs, it is reasonable to assume that environmental conditions have much to do with fluctuations.

The first state legislative protection given crabs was in 1897, when a law was enacted prohibiting the possession and sale of female market crabs. The next step was in 1903, when a minimum size limit of six inches across the back was required for the males. In 1911, this limit on males was increased to seven inches, thus protecting them through

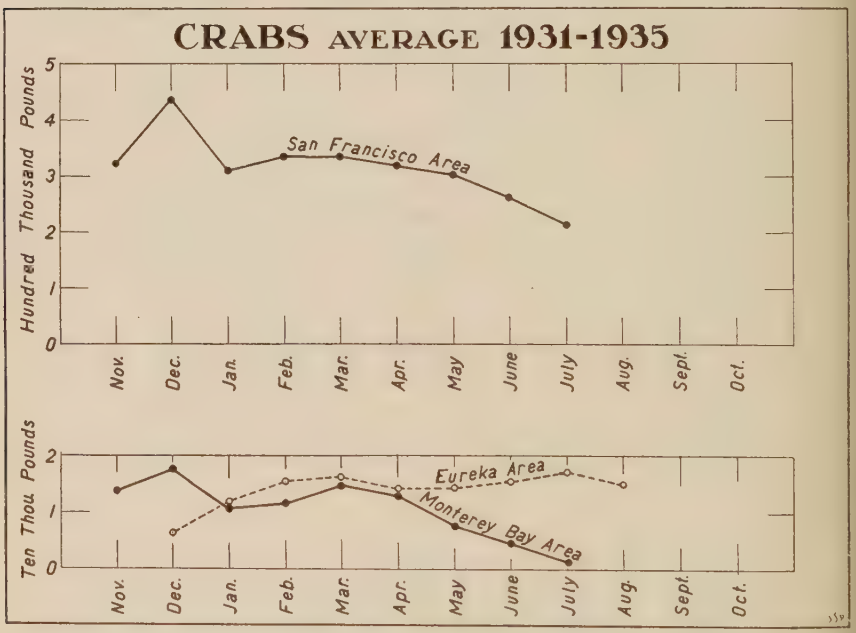

FIG. 89.

at least two breeding seasons and greatly eliminating the possibility of females being taken through inability to distinguish the sexes, as females seldom attain that size. It was also required that all crabs brought to shore or offered for sale be whole and in the shell so that they could be measured. Crabs imported from outside the state must fulfill the size limit requirements and also are subject to tagging and inspection. Importation of crab meat from Japan and Russia has been permitted when the containers are properly marked. This imported product can be distinguished from our own because of the texture and color of the meat as the crabs in these countries are of a different genus. However, crab meat importations from Alaska created a problem as the crabs taken there are of the same species as the California market crab. It was found that the law prohibiting sale of crab meat was impracticable and difficult to enforce. Imported

crab meat relieves the strain on the local supply as well as furnishes a supply of crab meat during closed seasons. Furthermore, in catching, cooking or handling local crabs, legs are broken off and these "cripples" are difficult to dispose of in the market. Unless these detached legs and the "cripples" can be picked and the meat sold, there is a waste of valuable food as well as a loss to the fishermen. In 1929, the law was amended to permit the sale of crab meat not in the shell.

Added to the ban on female crabs and the size limit on male crabs, there is a closed season on market crabs, which covers the main molting period. Growth is possible only during the annual period when the old shell is cast off and before calcification of the new shell fixes the size of the crab until the next molt. During this molting period the crabs are in the watery and unpalatable stage known as "soft." The first closed season was established in 1903. In 1929, different closed seasons were established for part of the state north of the Mendocino-Sonoma County line, as it was found that the crabs in the north molted a little later in the year than crabs to the southward.

In the Del Norte-Humboldt-Mendocino area even more stringent restrictions have been placed on market crabs, in the form of the crab export law, and for this reason the commercial fishery has not developed to the proportions of which it is probably capable. The present state laws for the northern area follow the lines of county ordinances evolved through local sentiment.

A law was passed in 1917, prohibiting shipment of market crabs outside of the coastal districts between the Oregon state line and the Mendocino-Sonoma County line. In 1923, this regulation was amended to prohibit holding crabs in live-cars in this area. The purpose of this latter regulation was to prevent fishermen from accumulating large quantities of crabs at one time and to discourage smuggling which was quite prevalent some years ago. Slight changes along this general line were later enacted upon complaint of citizens in the Eureka area, who declared that most of the crabs caught in the region were shipped out and that the local crab population was endangered thereby. Also, the local public was compelled to pay exorbitant prices for crabs caught off their own shores.

Crab hoop nets have been used by fishermen in the San Francisco and Eureka areas since earliest times. Until trammel nets were declared illegal in 1915 in district 17, which includes Monterey Bay, the bulk of the crabs captured in the bay were taken with trammel nets. From 1915 to the present, gill nets have accounted for most of the catch. Crab hoop nets have not been widely or successfully used in Monterey Bay until the spring of 1933. During the spring and summer seasons of the period, 1933-1935, a small number of Moss Landing fishermen operated home-made hoop nets successfully in shallow water between Moss Landing and the Pajaro River.

The type of boat that is regularly used in crab fishing is the jig boat. Most of the boats range in length from 20 to 35 feet and have engines of 6 to 12 horsepower, although a few boats in the northern part of the state are as long as 40 feet and have gasoline engines of up to 16 horsepower. At Moss Landing, on Monterey Bay, the hoop net fishermen operate from skiffs, some of which are provided with outboard motors. One man can operate a string of crab hoop nets,

whereas it takes two men to operate a string of gill nets or trammel nets.

Live-boxes have been used by the San Francisco and Eureka fishermen for many years. Each fisherman has a live-box tied to the wharf where his boat berths to hold crabs in excess of the immediate market demand. The yearly demand for crabs has not kept pace with the increase in numbers of fishermen, and consequently the limit of crabs that can be disposed of daily by fishermen has been rather low; in recent years about four to six dozen daily in the above areas. The use of a live-box enables a fisherman to hold several days' limit at one time without duplicating the expense of fishing each day and when weather conditions are inclement.

Live-boxes are not part of the equipment of the Monterey Bay crab fishermen. They can not be satisfactorily used in the bay because

FIG. 90. A portion of the crab boat fleet at San Francisco. These are the types of boats that fish for crabs in the San Francisco and Monterey areas. The boats fishing in the Eureka area differ a little in shape but are about the same in size. Note the stacks of crab traps on the stern deck of some of the boats. Crab hoop nets are used entirely in San Francisco and Eureka areas and gill nets are mainly used in the Monterey Bay area. Photo by J. B. Phillips, May, 1934.

of the bouncing around that the crabs receive when the water is rough. In San Francisco Bay and Humboldt Bay, the open sea condition is not encountered. One of the markets at Monterey has a live-tank in which crabs in excess of the immediate market demand are stored. If the supply of crabs in Monterey Bay were more dependable, more of the markets at Monterey and Santa Cruz would probably have live-tanks.

At San Francisco, all but 2 to 5 per cent of the crab catch is landed by fishermen who belong to the Crab Fishermen's Protective Association, commonly referred to as the Crab Union, which was organized in 1918 with a membership of 108 boats. At the present time, the membership is about 240 boats. There are no crab fishermen's associations in the other areas. Since the association has been in

existence in San Francisco, the price that fishermen there receive for crabs has been $2 to $2.50 a dozen. At other ports, the price has ranged from $0.65 to $2.50.

Market crabs are shipped out of the San Francisco and Monterey Bay areas to principal cities in California. The crab export law prohibits the shipment of market crabs out of the coastal districts north of the Mendocino-Sonoma County line.

The market crab sold in southern California is shipped in from Oregon and central California ports, mainly San Francisco, Santa Cruz and Monterey. The Oregon crabs are all shipped cooked and iced. Most of the San Francisco and Monterey crabs are preserved and shipped this way, but some are shipped alive and dry. Cooked crabs will keep in good condition for about two weeks on ice. Crabs will keep alive out of water for about twenty-four hours if they are cool and in a position to prevent moisture from draining off the gills.

Rock Crabs

The market crab is not exploited south of Monterey Bay because of its scarcity. In southern California waters, it is rarely taken, but several of its relatives, collectively called rock crabs, appear in fairly large numbers in these waters. These are *Cancer productus, C. antennarius* and *C. anthonyi.* In the Los Angeles area, these have been exploited in recent years by a few market fishermen as a side line to other forms of fishing. Although the rock crab catch has increased considerably during the past three years, 1933 to 1935, the annual deliveries are still less than 1 per cent of the state total of crabs landed annually. Rock crabs are also present in large numbers to the northward, but they are not utilized commercially from Monterey Bay northward because of the abundance of the more desirable market crab. When northern California fishermen catch any quantities of these crabs in their nets or traps, they save only the claw legs for marketing. The yearly rock crab record is given below:

Years	*Pounds*
1930	12
1931	56
1932	145
1933	14,818
1934	24,570
1935	12,817

In the Los Angeles Harbor area, rock crabs are taken in lobster traps, bass traps and hoop nets. Although most of the crabs are captured close to shore, a depth of 25 fathoms is sometimes fished.

Rock crabs are sold to fish peddlers and to markets. The crabs are sold either by weight or by the dozen. The markets usually buy them by weight and pay the fishermen 3 to 5 cents per pound. At some markets, the crabs are sold on consignment, the market men paying the fishermen later only on what has been marketed. Fish peddlers usually buy the crabs by the dozen at a price of 25 to 40 cents a dozen. The crabs average slightly under one pound apiece, the largest ones weighing as much as one and one-half pounds.—*J. B. Phillips.*

References (see page 164): 39, 77.

SPINY LOBSTER

California is indeed fortunate to have as a part of her heritage the California spiny lobster (*Panulirus interruptus*). This well-known crustacean has enjoyed great popularity among the people of the state and if legal restrictions had not been placed upon the taking of lobsters a number of years ago, it is doubtful if the species could have withstood the strain of the greater demands of the increasing population.

Years ago, according to some of the old timers along the southern California coast, lobsters were so abundant that by wading among the rocks they could be caught easily by hand, and even today we hear of an occasional specimen being taken by hand. Some few of the sport fishermen fish for lobsters from the rocks and piers with snag hooks and hoop nets, but this method of capture is of minor importance and is not a practical method if one's livelihood is dependent on the catch.

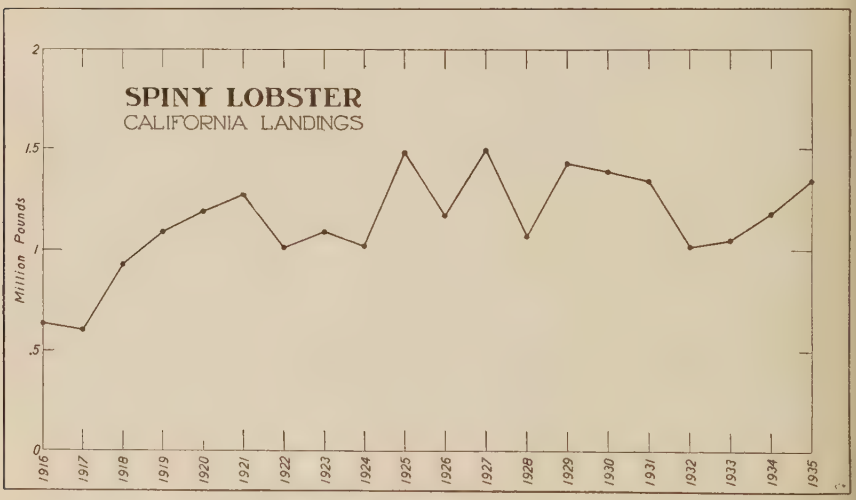

FIG. 91.

The standard method of capture for many years has been with a lobster pot or lobster trap. These traps are box-like crates, approximately 30 inches wide, 36 inches long and 15 inches high covered with lath slats or with woven chicken netting. They usually have two funnel-shaped openings in the top which are large enough to allow the lobster to enter freely but placed in such a position that he rarely finds his way out. The traps are weighted with rocks, bricks or blocks of concrete. They are usually seasoned by placing them in the ocean water for a short time. After this seasoning process, they are baited with fish or fish offal and then allowed to sink to the bottom of the ocean in the vicinity of a rocky shore where there is some kelp. The trap is raised to the surface each morning by a line which is attached to a buoy floating on the surface of the water. The lobsters are then removed and sorted. The "shorts" and "oversized" are returned to the water alive while the "legals" are thrown loosely in the boat or into a temporary container. The bait supply in the trap is replenished

and the trap is lowered for another night's fishing. After the rounds of the traps have been made and the fishermen return to their camp or anchorage, the catch is transferred to "receivers" (shallow slat covered crates) which are anchored in the water so that the lobsters will remain alive until they can be delivered to the market.

The spiny lobster is found from Point Conception south along the coast of Mexico and down into Central America. They are also found up into the Gulf of California but have been exploited only to a very minor degree in this area. There are four major lobster landing ports in California—Santa Barbara, San Pedro, Newport Beach and San Diego. The fishing areas of the three northern ports somewhat overlap although in general the bulk of the catch landed in any one of the ports is caught in adjacent coastal waters or in waters off the nearest of the Channel Islands. San Diego is the leading lobster port of the coast, due in most part to the landings of Mexican (west coast) lobsters. In fact, San Diego receives almost the total of the Mexican importations. These are brought in by tenders which pick up the loads from camps located below the international border, some as far as 500 miles south.

The laws are designed to protect the lobsters and provide a steady supply. They have been changed from time to time but we have had size and seasonal restrictions for many years. In addition to this there have been certain areas closed to the use of traps (in most cases incidental to the closing of the area to the use of nets) which has given some added protection. During the year 1935 (and for some years previously) the legal size was a minimum of 10½ inches and a maximum of 16 inches measured from one extremity to the other and exclusive of legs, claws or feelers. The minimum size was designed to allow the lobster at least one or two spawning seasons before it could be taken. The maximum size of 16 inches was probably more of an economic measure than a biologic, but it does protect the large members which are thought to be more prolific and not as desirable as food. The larger lobsters, those over 16 inches, have very little market demand so that it is a waste to attempt to take them in any quantity.

For many years the open season for the taking of lobsters was from October 15 to March 1. In 1933 the season was changed to remain open from September 1 to February 1. This new season proved very unsatisfactory mainly because of the early opening date. It was found that many of the lobsters taken in the early part of the season were still in the soft shell stage (the lobster sheds its shell each year and grows a new one, thus allowing for increase in size) and that they were not marketable because of the large shrinkage and mortality before cooking. In 1935 the legislature changed the season to remain open from October 1 to March 15, which made it similar to the old season of two years before and more satisfactory.

Under the law, lobsters imported from Mexico may be sold at any time of the year provided they conform with our size limit and provided they are imported in accordance with the State Division of Fish and Game regulations. The regulations require that they be properly identified as imported lobsters by a "punch" which is made in the tail at the time of importation. This is done under state supervision. Previous to 1935 Mexican lobsters could be imported at any time of the year but effective September 15, 1935, it was provided that Mexican

lobsters may be imported only during the California open season although they may be held in cold storage and sold at any time. This new regulation will probably result in a greater stabilization of the market and will possibly result in increased importations from Mexico.

It will be noted in figure 92 that a major part of the total landings of the state consists of Mexican catch and also that these importations fluctuate a great deal more than the local take, which has remained fairly constant, varying less than eighty thousand pounds during the

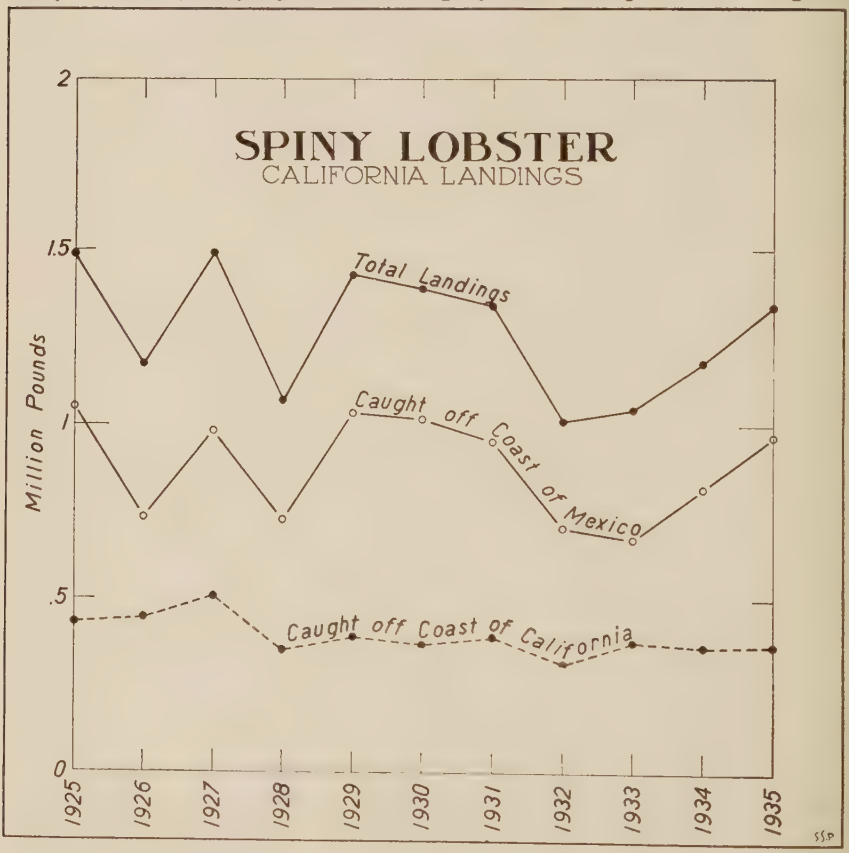

Fig. 92.

past eight years. Lobsters are necessarily a luxury because of the expense involved in catching and handling them, and the big drop in the total and imported landings from 1929 to 1933 was undoubtedly due in a large part to the decreased demand as a result of general economic uncertainty of these years.

The increase in landings in 1934 and 1935 was due in part to the general bettering of economic conditions. The change in the law covering the importations and sale of imported lobsters during our closed season had some effect upon the increased landings of 1935. The dealers could expect a steadier demand for frozen lobsters uninter-

rupted by the small irregular supply of imported fresh lobsters during the local closed season.

There have been several unsuccessful attempts to import lobsters from the Gulf of California. Most of these importations have been made by the dealers who import totuava from the Gulf of California by truck or rail.

Lobsters are one of the leading products handled in the fresh fish markets of the state. The value of the fishery based on price paid to the fishermen falls considerably below the crab fishery of the northern part of the state during most years, but there have been occasional years during which the value of the lobster landings has exceeded that of crabs. In San Diego it ranks highest in value of all the fresh fish products handled by the markets.—*L. G. Van Vorhis.*

References (see page 164): 1, 55.

SHRIMP

The shrimp industry is confined to San Francisco Bay, where in the southern part of the bay, Chinese shrimp nets are used and in

FIG. 93.

the northern, beam trawls. The catch is composed of three species—*Crago franciscorum, C. nigricauda,* and *C. nigromaculata.* At Monterey in deep water a few prawns (*Pandalus platyceros*) are taken with traps. This same species is shipped into the state from Alaska. Other prawns (*Penaeus sp.*) come from the west coast of Mexico and the Gulf of Mexico.—*Paul Bonnot.*

References (see page 164): 7, 56, 63, 83.

ABALONE

Since 1916, abalones have gradually become one of our more important marine market products. Between 1916 and 1919, they ranked fifteenth to twenty-second in the market list, but since 1928 they have been fifth to seventh, as based upon poundage landed. During the twenty-year period, 1916–1935, the average annual catch has been a little over two million pounds, whereas during the past ten years, 1926–1935, the average poundage has been slightly under three million a year.

Until the Chinese came to California during the gold rush days of the early 1850's, the Indians were the only ones to utilize the abalone to any extent. The Indians not only consumed the flesh but also used pieces of abalone shell as money. The white people who settled in California did not appreciate the shellfish as food for many years. The Chinese living near the coast recognized with pleasure the shellfish that they had known as a delicacy in their homeland. At first the Chinese gathered abalones for their own use, but about 1864 they commenced drying the meats and shipping them to China, where the dried products met with ready sale. The Chinese used only the meats and threw the shells away. Some white men saw the possibilities of manufacturing ornaments and curios from the shells, and by 1879 the value of the shells was about twice that of the meats. As late as 1913 the manufacture of ornaments and curios was an important part of the abalone industry. Not long before the demand for abalone curios and jewelry decreased, the California manufacturers of these articles were instrumental in having a law passed prohibiting the export of

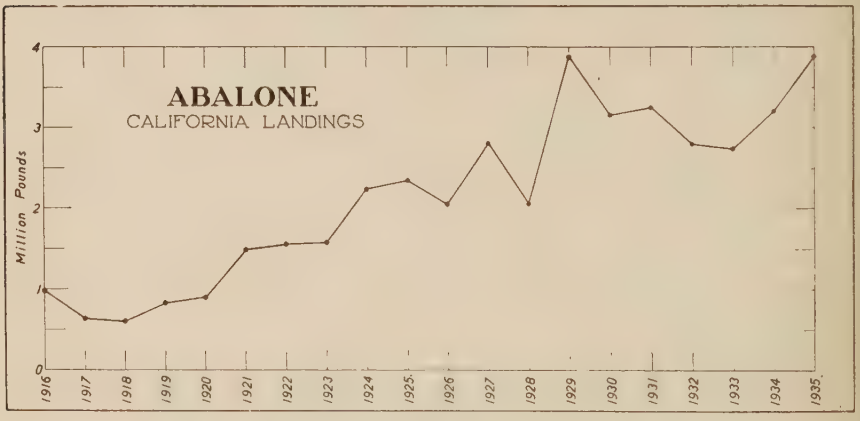

FIG. 94.

unfinished shells from the state. Drying of abalone meat continued until 1915 when a law was passed putting an end to this practice. Canning of abalones commenced at Cayucos about 1905, and later was done at Point Lobos, San Pedro and San Diego. In 1917 there were five plants canning abalones in California and in 1923 there were but three. The last cannery to operate was the one at Point Lobos, which ceased operations in 1931. This phase of the abalone fishery never became very important because the greatest demand was for the fresh product. Less than half of 1 per cent of the total deliveries during the 1916–1935 period was canned; the balance was marketed fresh.

All abalones belong to the family Haliotidae, and the only genus on the Pacific coast is *Haliotis*. Only four species are found in large enough numbers in California to deserve mention. These are the red abalone (*Haliotis rufescens*), the southern green abalone (*H. fulgens*), the corrugated or pink abalone (*H. corrugata*), and the black abalone (*H. cracherodii*).

Abalones are found in various parts of the world along rocky coasts. The several north American species are found only on the

Pacific side from Mexico to Alaska, but are of little importance north of California. The red abalone is the only one of commercial importance in California. It is found from low tide to an undetermined depth, ranging from northern California to Lower California, but is scarce south of Santa Barbara. It attains a length of 12 inches and is the only one that commonly reaches the commercial size limit of 8 inches. The southern green and the corrugated (pink) abalones attain a length of about 7½ inches, and are normally found a little beyond the extreme low tide from central California to the Gulf of California. The black abalone is smaller, 7 inches maximum size. It is distributed from Point Arena to Lower California.

In contrast to the others, the black abalone is found on rocks supporting little or no algal growth and rarely below extreme low tide. The red, corrugated and southern green species feed almost entirely on brown algae of various forms, whereas the black abalone feeds mainly on diatoms and floating bits of vegetation. In addition to these species there are several other kinds of abalones found in California which are either too small or too scarce to warrant gathering either by commercial or sport fishermen.

Noncommercial fishermen collect abalones when rocks are exposed at low tide or by means of a small boat in calm shallow water. In the former case, a short section of a narrow flat iron, bluntly sharpened and pointed at one end, is used to pry abalones off rocks. In northern and central California, experienced abalone hunters choose a very low tide and wade out, sometimes hip deep, and feel around under and between likely rocks. South of Point Conception, one must be careful not to shove one's arm inside the home of a moray eel. In southern California, some gathering is done from small boats. In this case, the abalones are located by looking through a small box with a glass bottom, which is shoved just below the surface of the water and thus the visibility is increased by eliminating surface disturbances. A long-handled gaff for dislodging the abalone and a scoop net to catch the dislodged abalones, complete the equipment.

Japanese have dominated the commercial abalone fishery of California since about 1900, when they replaced the Chinese. The Japanese developed the deep water or diving phase upon which the large commercial fishery of today exists. Commercial operations were forced into deep water first about 1900, when Monterey and other seaboard counties passed an ordinance which made it unlawful to fish for abalones except in deep water. The county supervisors had become alarmed at the rate at which abalones between the tidal zones were being depleted.

At Monterey, other nationalities aside from the Japanese have not been successful in diving for abalones. The Japanese must be credited with developing the fishery, although at Morro a crew of Americans has successfully carried on diving operations for a number of years. The number of crews operating out of Monterey had increased to 8 in 1928, 11 in 1929, and 14 in 1933. At Morro and Avila, the number increased from 1 to 3 in 1931 under the impetus of widened fishing territory with the opening of the stretch of coast from Pico Creek to Point Buchon in 1929. This stretch was opened at the request of the Monterey abalone interests.

During recent years boats from 45 to 60 feet long have been equipped to serve as a base and living quarters for abalone crews while away from port. Most of the boats have 40-horsepower gasoline engines. Actual diving operations are carried on from a smaller boat or tender which is towed by the larger boat. The diving tenders are about 25 feet long and are equipped with 5- to 8-horsepower gasoline engines, which not only drive the boat but serve to pump air for the diver.

At present a diving crew consists of five men. Previous to about 1920, 7 or 8 men were needed. The reason for the decrease since 1920 has been the installation of mechanical air pumping in place of the laborious hand-pumping method, which required the services of at least two additional men. The crews work on a share basis, the diver receiving two shares and the rest one share each, with one each for the boat and tender, or a total of eight shares for a five-man crew.

FIG. 95. An abalone boat at Monterey, with the diving tender alongside. The larger boat is about 45 feet long and has a few live-boxes secured on the afterdeck. Photo by J. B. Phillips.

When the desired collecting grounds are reached, the larger boat is anchored a quarter-mile from shore. Four men embark in a diving tender. One man dives, one man sculls the tender from the stern with a long thin-bladed oar, one cuts kelp when necessary with a long-handled knife, and the remaining man handles the air hose and life line. The diver's outfit consists of a canvas suit, heavily weighted shoes, breast plate, bronze helmet, and usually canvas gloves. The diver carries a flat piece of iron to pry abalones off the rocks and a bag which can be pulled to the surface when filled with abalones. The sculler at the stern watches for the stream of air bubbles and manipulates the diving boat in order to keep up with the operations of the diver. A diver will sometimes work under water for six hours before coming to the surface.

The abalones are sorted and measured on the tender. When the tender is loaded, the catch is conveyed to the larger boat, where the abalones are stacked in a slanting position on wetted matting on the

afterdeck and covered with sacking. Sometimes as many as 300 dozen abalones are gathered before the boat returns to port. Since 1930 abalones have been stored in live-boxes on the collecting grounds until the boat is ready to return to port, when the boxes are picked up and the abalones stacked on the afterdeck.

FIG. 96. Unloading an abalone boat at Monterey. Visible are a number of live-boxes used for holding abalones on the collecting grounds. Photo by J. B. Phillips.

Before the general use of live-boxes by Monterey boats, usually two-day trips were made; but since then the length of the trips has increased to three or five days. As the Monterey boats fish mainly along the strip of coast line, 10 to 90 miles south of Monterey, the length of the trips varies somewhat with the locality fished. Nevertheless in recent years these abalone crews have been making longer trips because they are having a more difficult time in supplying the demand.

Upon returning from the fishing grounds with a catch, the boat is brought alongside the market dock and unloaded and the catch carted to the dressing sheds. The meat is first removed from the shell with the aid of a pointed metal strap, the viscera are detached and the meat is trimmed, leaving nothing but the muscle. The muscle is washed carefully and sliced on a hand-operated machine, adjusted to cut slices about one-third of an inch thick. The slices are sorted as small or large, beaten on a block of wood with a wooden mallet to soften the meat, and packed in paper-lined, five- and ten-pound boxes. If not shipped immediately, the boxes are stored in the ice box. A small proportion of the abalone meats are sometimes dark instead of the usual whitish color. The dark meats do not command as high a price although they are just as palatable as the lighter.

Since 1916, the price paid fishermen for abalones has been $1 to $2 per dozen; the average price during the 10-year period, 1926–1935, being $1.80. The wholesale price of large abalone steaks during these 10 years has been between 35 and 45 cents a pound. Small steaks bring about 4 cents a pound less, and the dark meat about 10 cents a pound less than the light.

In 1913, the Coast Abalone Company at Monterey first marketed sliced abalones. In 1931, the slicing of abalones commenced at Avila, San Luis Obispo County. Previous to 1931, although abalones were landed regularly in this region they were shipped whole from Morro and prior to 1920 they were canned at Cayucos.

The annual catch of abalones landed in California during the 20-year period, 1916–1935, is plotted in figure 94. The average yearly deliveries during this time was a little over two million pounds. The poundage is calculated on the basis of 50 pounds to a dozen abalones, alive and in the shell. These figures include importations from Mexico, which varied from 800 pounds in 1925 to a little over 448,000 in 1929. During the latter part of 1929, the Mexican government prohibited the exportation of fresh abalones.

During the period 1916–1935, Monterey has been the most important port for abalone landings. During these years, 88 per cent of the state total, including deliveries from Mexico, was landed at Monterey, 10 per cent at Cayucos, Morro and Avila, and 2 per cent at San Diego and San Pedro. The bulk of the San Diego and San Pedro landings was from Mexico. Insignificant amounts of abalone are occasionally landed commercially as far north of Monterey as Crescent City.

The landings at Avila and Morro have increased during the past four years, under the impetus of the opening of the Pico Creek-Point Buchon area in 1929. During the years 1932–1935 the proportion of the state total catch at Monterey dropped to slightly less than 78 per cent, and that of Avila and Morro, combined, increased to 22 per cent, with an insignificant amount landed at other places in California. In 1935, the poundage credited to Monterey was only 69 per cent of the state total, and the poundage for Avila and Morro rose to almost 31 per cent.

Although abalones are taken all along the California coast, at present (1936) diving or commercial gathering is only permitted in Districts 6, 10 and 18 and in not less than 20 feet of water. Since 1916, the commercial fishery has been carried on almost entirely between the mouth of the Carmel River and Point Buchon to the southward. A

few trips have been made by Monterey crews into District 10, north of Pigeon Point. The Morro and Avila boats operate inside of Point Buchon to Point Piedras Blancas. The bulk of the abalones landed at San Diego and San Pedro has been taken from the Mexican boundary southward to Abreojos Point.

Since 1929, it appears that the commercial fishery in District 18 is approaching the annual maximum yield of legal-sized abalones. However, under the present well-formulated laws, this yield can probably be maintained.

Since the turn of the century, a number of state regulations pertaining to abalones have been enacted and existing regulations improved, until today the abalones of California have become one of our most efficiently protected marine fisheries, and at the same time the people of the state are deriving the fullest benefits of this resource. At the 8-inch commercial size limit, the red abalone, which is the only abalone in California that commonly attains this size, is about 13 years old and has had approximately seven successive years of spawning. Even at the 7-inch noncommercial limit, this species is about 11 years old. Restrictions are also in effect as to the minimum size limit at which the green, pink and black abalones can be taken and marketed. In addition to these size-limit laws, there are various other regulations which have been found to be effective in the conservation of these abalones—these include the following: permitting commercial gathering only in certain districts and in water not less than 20 feet deep in such districts; bag limits; closed season during the height of the spawning period; diving and spearing restrictions; regulations on marketing, preserving, importation and exportation; and utilization for human consumption only. There are also certain regulations governing the noncommercial gathering of abalones.—*J. B. Phillips.*

References (see page 164): 4, 48, 53.

SQUID

Squid are one of our most variable marine fishery products, variable in supply as well as demand. During the twenty-year period, 1916–1935, the annual catch has ranked as high as first place and as low as twenty-sixth place in the market fish list. The average yearly catch has been about two and a half million pounds. When both cannery and market fish are considered, squid have never ranked higher than fifth place and have been as low as thirty-second during these twenty years.

Squid and some other edible marine animals, such as octopus, abalone, scallops, oysters and clams, belong to the phylum Mollusca. The squid and octopus differ from other members of this group in having the muscular foot, common to all members of Mollusca, divided into arms supplied with suckers. The squid has ten arms in all and the octopus has eight. "Cuttlefish" is the name sometimes given to certain species of squid that have the chitinous pen, which is imbedded in the mantle and reinforced with a calcareous material called cuttlebone.

The most important squid in California is the common squid (*Loligo opalescens*), found from Puget Sound to San Diego. This species attains a length of 12 inches, although the usual market size is 8 to 10 inches. The only other squid of commercial value in Cali-

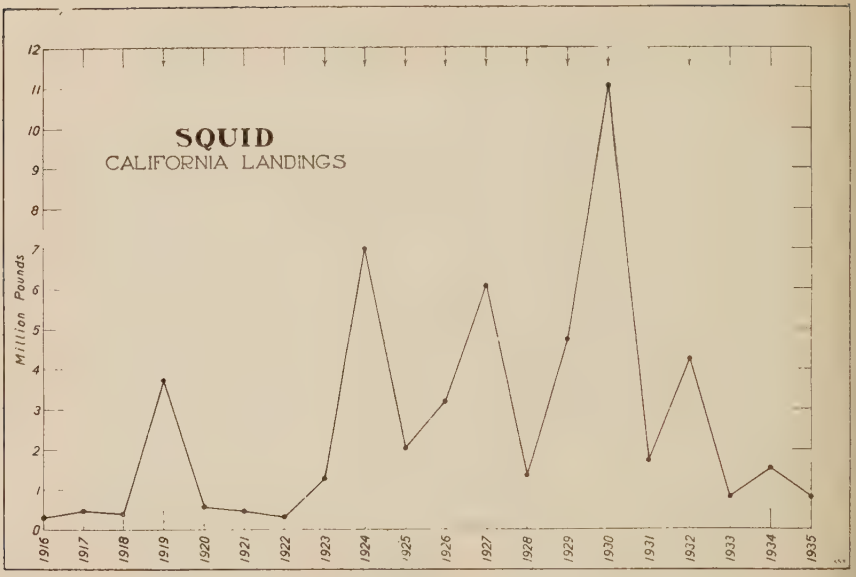

FIG. 97.

fornia is the jumbo squid (*Doscidicus gigas*), which reaches a length of 4½ feet, although the usual market size is 2 to 4 feet. The market demand for this species does not compare with that for the common squid. The jumbo squid is taken only during certain years when water conditions are favorable. For example, during the summer of 1934, jumbo squid, which had been scarce for many years, suddenly appeared in appreciable numbers in southern California waters. That year and again in 1935, the poundage of this squid exceeded the common squid

FIG. 98. Common squid delivered by lampara launches at Monterey. The launch next to the wharf is being unloaded by means of a bucket hoist. The bulk of this squid was dried for export to China. Photo by J. B. Phillips, May, 1930.

deliveries in the south. During the summer of 1935, jumbo squid were landed at Santa Cruz and Monterey but not in such quantities as at San Pedro. During 1934 and 1935, the jumbo squid catch in California was nearly 3 per cent of the total squid poundage for these years.

The fishing grounds for market squid in the Monterey and southern California areas are usually not more than fifteen miles from port.

Prior to 1905, squid fishing was done by Chinese using small purse seines and skiffs. In 1905, Italian fishermen at Monterey introduced the lampara or round haul net, of Mediterranean origin, and since then the lampara net has been used mainly for the capture of squid. The Chinese attracted the squid at night by means of flares from a "fire boat," but since the introduction of the lampara net and power boats, the schools of squid have been located at night by the characteristic luminescence or glow they create in the water. Five men usually compose a crew. Catches of more than 15 tons at one haul are not desirable as squid are difficult to haul and bunch.

Jumbo squid are caught in nets and with lines. In the latter case, they are caught incidentally to other fishes.

The total yearly squid poundage of California for the period, 1916–1935, is shown in figure 97. The annual catch usually varies a great deal from the average, which is about 2,500,000 pounds. For example, the lowest poundage, in 1922, was slightly over 200,000 pounds; and the highest, in 1930, was slightly under 11,000,000 pounds. Even the deliveries for two successive years may vary widely, as for example, the drop from about 11,000,000 pounds in 1930 to about 2,000,000 in 1931. The wide fluctuations from year to year are due to availability of the squid and to the demand for dried squid for exportation to China. There are no legal restrictions that pertain to the capturing or marketing of squid.

The average monthly poundage of squid in California for the five-year period 1931–1935 has been plotted in figure 99. This figure also includes a monthly comparison for four of the five years when no squid were dried. Squid are landed in varying amounts during all months of the year, but May is usually the "peak" month, and the period May to July usually accounts for about 50 per cent of the annual total.

Upon combining the yearly squid catch of California for the years 1916–1935, it is found that 97 per cent of the combined poundage was landed at Monterey, 2 per cent at Los Angeles and 1 per cent at other ports. However, during one earlier year, the Los Angeles poundage was as high as 27 per cent. Although for ten of the above twenty years, no squid were dried commercially at Monterey, this region received 87 per cent of the state total. It is apparent that even during years when no squid are dried, Monterey remains the chief squid port of California.

Market squid are sold fresh, canned and dried. During 1916 to 1935, 40 to 45 per cent of the combined catch was dried, about 7 per cent canned, and the balance sold fresh. The percentage of dried squid was computed on the basis of three and one-half tons of fresh squid to produce one ton of the dried product.

Commercial drying of squid has been confined to the port of Monterey. As early as 1888, the drying of squid for export to China

was an important Monterey industry. This phase of the squid fishery has depended mainly upon the stability of silver, the medium of exchange in China. In recent years there also has been an increasing amount of competition with squid dried in Japan. Dried squid was worth as high as $160 a ton at San Francisco in 1928.

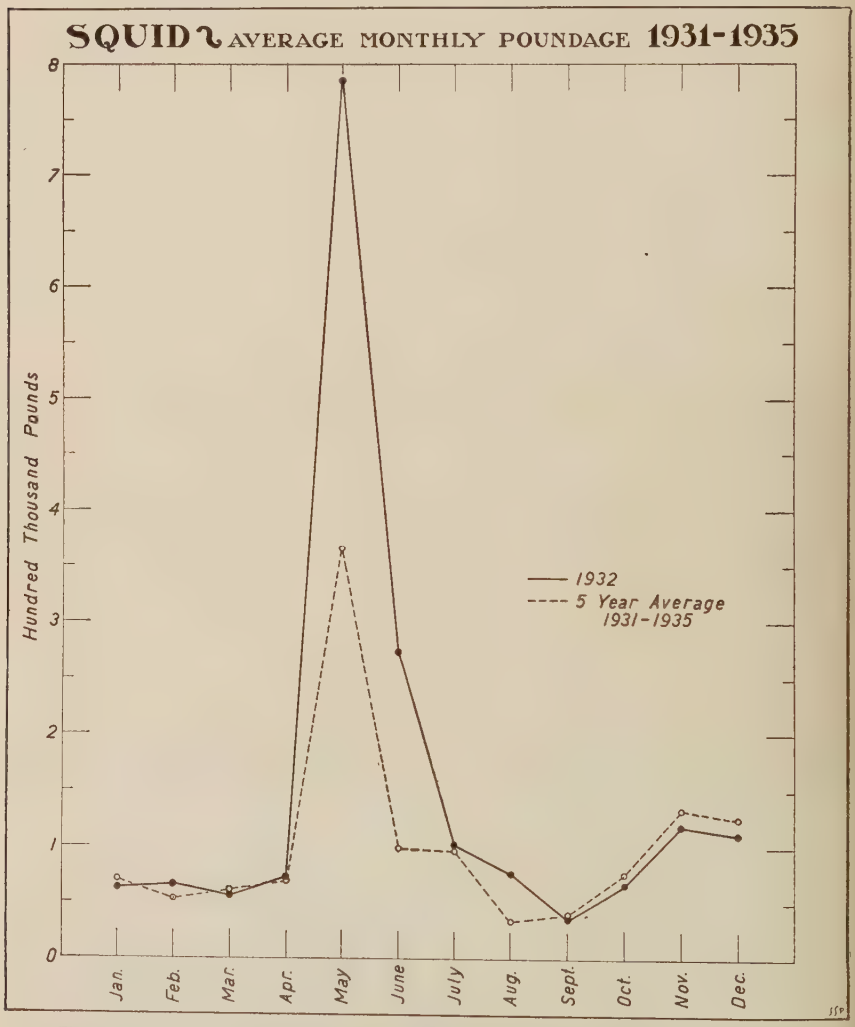

FIG. 99. The average monthly poundage of squid landed in California for the five-year period, 1931-1935, inclusive, compared with the landings for 1932, the year when squid were dried.

Sun-drying is the preferred method. Mechanical drying experiments have been made, but it was found that the Chinese trade demanded the sun-dried product because of flavor, oiliness and better keeping qualities. In earlier years, squid were dried on trays, but in later years the drying has been done on a larger scale by simply

scattering the squid in open fields. (See Fig. 100.) A small amount is fancy-dried, that is, split and dried on bamboo screens.

The drying of squid at Monterey has been done chiefly during April to June. During these months, squid are usually readily available close to port, sardine fishermen resort to this fishery temporarily, and weather conditions are suitable for sun-drying.

Canning of squid during recent years has been confined to Monterey, although in earlier years some squid were also canned at San Diego. Most of this product has been exported to Greece, where it is considered a delicacy. During recent years, an attempt has been made to interest the American trade in the canned product.

Fresh squid are sold mainly along the Pacific slope and in the eastern United States. In the latter case they are frozen for shipment. Retail sales of squid are mainly confined to people of a few nationalities who have cultivated a taste for this cosmopolitan mollusk in the land of their birth.

FIG. 100. A dried squid "factory" at Monterey in 1930. The group of men in the distance are raking over the squid that have been trucked from the fishing boats and scattered on the field to sun-dry. When dry, the squid are raked up and piled, as shown in the foreground. They are allowed to "sweat" and soften in the piles, after which they are dumped onto the conveyor that carries and drops them past a blower-pipe that blows away dirt and chaff. The dried squid are then pressed into bales for shipment to China. A number of bales can be seen at the left. In earlier years the dried product was sacked.

This was one of three concerns that dried squid at Monterey during the record year of 1930. The same routine was used by the other two concerns, except for variations in the cleaning process. One concern used a shaker rig (of earlier origin) to remove chaff and dirt. Photo by J. B. Phillips, May, 1930.

Squid for drying brings the fishermen from $8 to $15 a ton. During recent years a great deal of fresh squid has been frozen by a San Francisco firm for shipment to the east. Fishermen have been receiving $25 a ton from this concern. The wholesale markets have in recent years been paying fishermen 2 to 5 cents a pound, the price being regulated by the quantities taken.—*J. B. Phillips.*

References (see page 164): 27, 35, 75, 88.

OCTOPUS

Compared with our other fisheries, the octopus catch of but 63,000 pounds annually does not bulk very large. But just try to visualize 31½ tons of these slimy, crawling, clinging monsters of the deep all in one gruesome pile and you will agree that the octopus deserves at least some sort of mention back toward the end of this bulletin.

Just what is an octopus that it should call forth such words as slimy, crawling, clinging and gruesome? Otherwise known as devilfish, the octopus is a cephalopod mollusk, related to the squid and more remotely to clams, abalones and oysters, not to mention garden snails. An octopus has a globular body equipped with a pair of beady eyes, a set of parrot-like jaws and eight long tentacles bearing sucking discs. Colors are variable and frequently change before one's eyes as wave after wave of black, brown, purple and white flow across the grisly body. Many are the tales, most of them imaginative, of luckless fishermen and swimmers caught by the tentacles and dragged down to a miserable death in the depths.

Who, then, eats these repellent creatures? People of Oriental and Mediterranean extraction are very fond of octopus, prepared as only

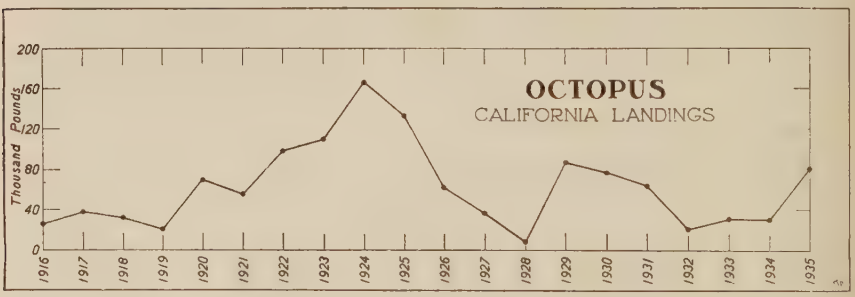

FIG. 101.

these epicureans can cook. Most of the few others who have screwed up their courage to the point of gnawing on a tentacle have made favorable reports also. To the public in general, however, the octopus remains inedible.

Where are they caught? The octopus of commerce (*Polypus hongkongensis*) is caught in fairly deep water on a rocky bottom. The California fishery centers at Monterey. Smaller catches are made at San Francisco and Eureka, and sometimes small amounts are landed at southern California ports. The 1935 catch of 81,000 pounds was divided as follows:

Monterey	55,000 pounds
San Francisco	24,000 pounds
Eureka	2,000 pounds

Who catches the octopus and how? Italian fishermen at Monterey catch them in baited traps known as devilfish pots, which are lowered on ropes to the bottom of the sea. The hungry octopus enters the funnel at one end of the trap and then in spite of his eight "legs" can not find a way to walk out again. Even unbaited pots are effective, as the octopus likes to back himself into a dark hole to lie in wait for his prey,

and the open doorway to the trap looks like a good den. The octopus traps also catch starfish, sea-urchins, whelks, prawns and other deep-sea delicacies. In addition, some part of the total catch is accounted for by various kinds of nets and lines being used for the capture of other varieties of sea foods. Paranzella nets, fishing for flatfish, are perhaps second in importance to the devilfish pots.

Are all octopi horrible? Indeed, not. In tidepools and bays along the southern California coast there occurs a small and rather pretty species of octopus (*Polypus bimaculatus*). This brightly colored, spotted creature rarely exceeds twenty inches in expanse whereas the big devilfish attains a spread of twenty feet. At low tide, octopus enthusiasts fare forth with gaff hooks or bare hands and fish the hiding little beasts out of the rocks and into gunny sacks. And many an angler when reeling in his line discovers he has caught an octopus and has to laugh at the comically savage antics of this miniature replica of the dreaded devilfish.—*Richard S. Croker.*

Reference (see page 164) : 76.

OYSTERS

The present oyster industry is based on three species—the native (*Ostrea lurida*) used almost exclusively for cocktails, the eastern (*O.*

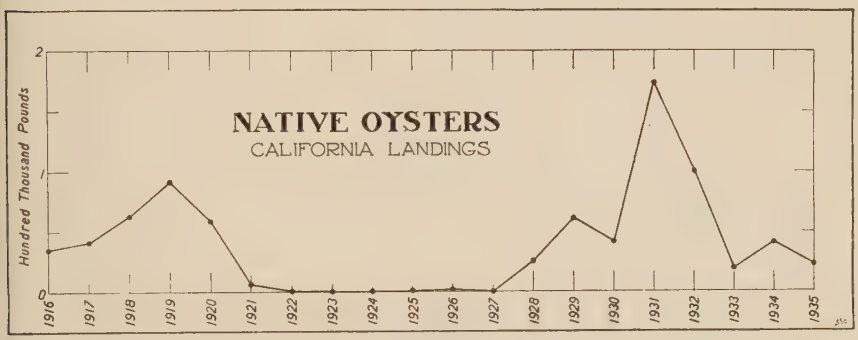

Fig. 102.

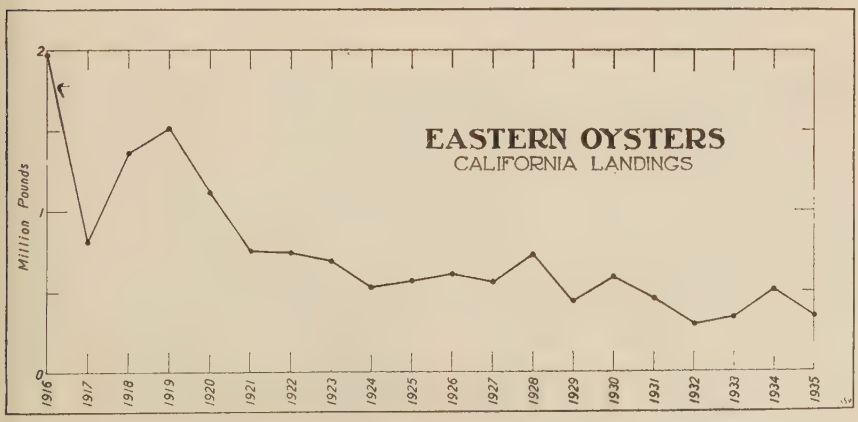

Fig. 103.

virginica) for half-shell and cooking, and the Japanese (*O. gigas*) for cooking and canning. The native is the only indigenous species and the natural beds, at the present time, are exploited solely as brood stock. The easterns and Japanese are brought in as seed and grown to maturity in various bays. So far easterns and Japanese have not reproduced and the seed must be imported annually. For a number of years, California has imported the major portion of the oysters sold but in a few years, with the present program of development, the industry should be able to supply the demand from locally grown stock.—*Paul Bonnot.*

References (see page 164): 9, 66, 67, 85, 86.

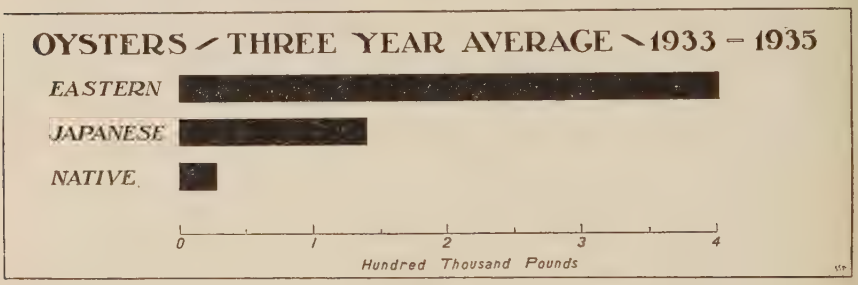

FIG. 104.

Japanese Oysters

1933	68,762 lbs.
1934	50,240 lbs.
1935	299,375 lbs.

CLAMS

The commercial clams are in order of importance:

Pismo (*Tivela stultorum*)
Soft-shell (*Mya arenaria*)
Cockle (*Paphia staminea, Chione sp.*)
Gaper (*Schizothaerus nuttalli*)
Washington (*Saxidomus nuttalli, Saxidomus giganteus*)
Razor (*Siliqua patula*)
Jackknife (*Tagelus californianus*)
Bean (*Donax gouldii*)

Pismo clams are confined to a few localities where they occur on open sandy ocean beaches. As the present law forbids shipment they are all utilized locally. Soft-shell clams are taken in commercial quantities only in the San Francisco Bay region. Although they occur in all bays north of San Francisco, they can not be found in quantity unless protected from the sting rays by a stake fence. The soft-shell is not a native but was accidentally introduced from the east coast with the first shipments of eastern oysters. The gaper is found along the entire coast and is used as a substitute for the more desirable Washington clam which is seldom found in one locality in great quantity. Very few of the cockles on the market are gathered locally. The larger part comes from the Puget Sound region. Razor clams are a northern species and are found in only a few areas. They require an open sandy ocean beach, whereas the jackknife lives in the mud in sheltered bays.

The little bean clam lives on the ocean beaches in the southern part of the state, sometimes becoming so abundant that the waves wash them up on the beaches in windrows.—*Paul Bonnot.*

References (see page 164): 8, 23, 61, 102, 103.

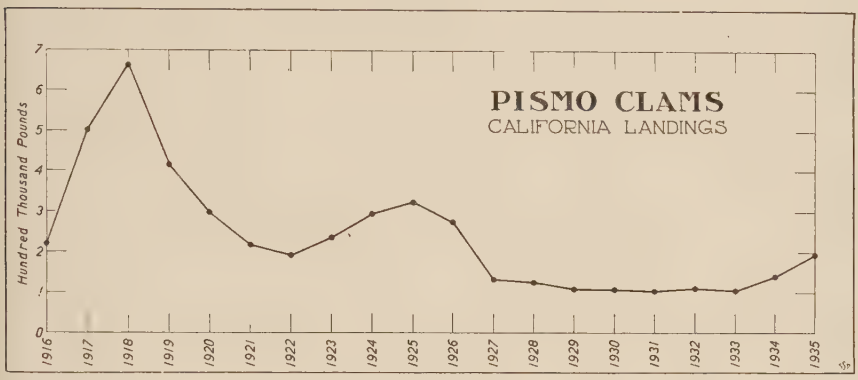

FIG. 105.

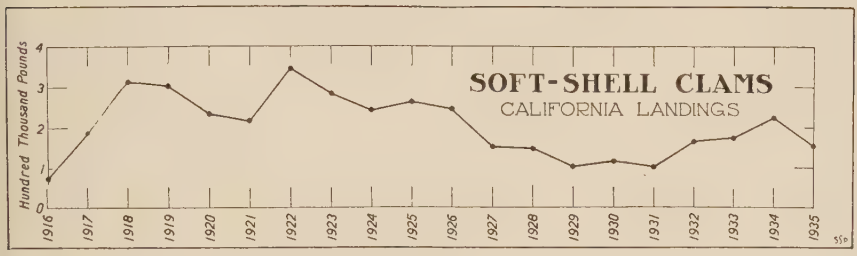

FIG. 106.

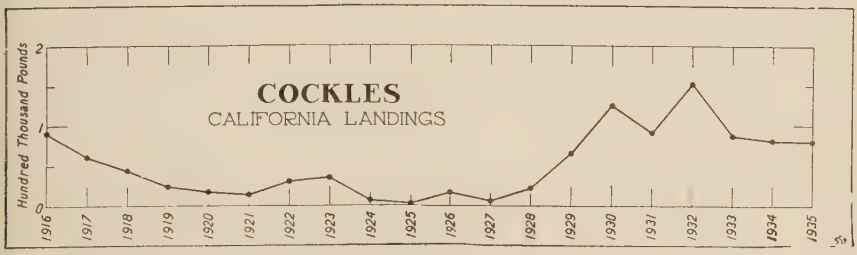

FIG. 107.

Miscellaneous Clams

Year	*Pounds*	*Year*	*Pounds*
1916	534,291	1926	35,202
1917	308,497	1927	64,663
1918	129,084	1928	44,662
1919	66,744	1929	13,498
1920	79,875	1930	17,266
1921	59,832	1931	41,235
1922	35,291	1932	31,091
1923	25,845	1933	31,187
1924	49,379	1934	44,538
1925	61,839	1935	46,496

TURTLES

The green turtle (*Chelonia mydas*) is the turtle taken commercially on the Pacific coast. It is found in tropical and semi-tropical seas throughout the world, occasionally wandering into more northern waters. On the Pacific, its distribution ranges from southern California southward, and on the Atlantic from Long Island to Central America. In the United States, the chief turtle fishery is in the vicinity of Key West, Florida.

The poundages of turtle appearing in the California statistical records are mainly derived from a fishery concentrated along the coast of Lower California. Only occasional wanderers are taken in southern California. As shown in the accompanying figure 108, the largest deliveries to California were made during 1919 and 1920, when approximately 255,000 and 77,000 pounds, respectively, were landed. This

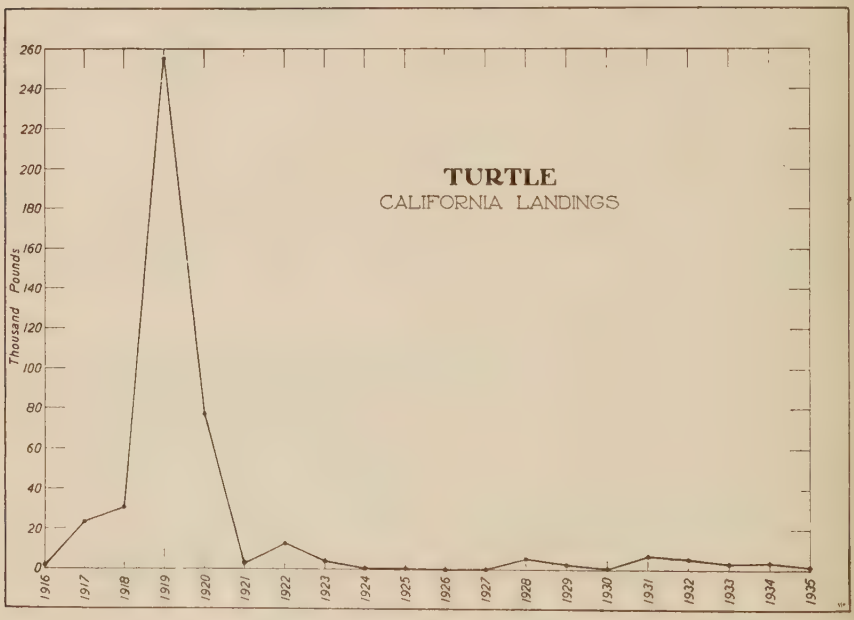

Fig. 108.

increase may have been due to the efforts of a 50-ton vessel which was especially built to handle the turtle trade between Lower California and San Diego. Its deliveries were made to a San Diego cannery which produced green turtle products. In 1921 the landings dropped to 2571 pounds. At the present time, only one or two boats occasionally make small deliveries to San Diego, but these are so spasmodic that a constant market can not be maintained, with the result that the fishermen find it difficult to dispose of their catches whether large or small. In recent years, the Mexican government has imposed exportation and exploitation duties on turtles, which may have had some effect on the decrease in deliveries to California ports. The average market price for turtles as paid to the fishermen in California during the last seven years has been five to ten cents per pound.

The turtle fishery in Mexico is now supplying canning plants in that country, which are packing a stewed turtle product similar to turtle soup. The Mexican government has provided for the conservation of this species by establishing closed seasons and prohibiting the taking of undersized turtles.

Turtles are caught in gill nets of 18 to 22 inch mesh, fairly heavy thread. The net is usually set across a slough on the flood tide, and the turtles which drift in schools go out on the ebb and become entangled in the net. A light weight harpoon, which does not injure the animal when speared, is used by some natives of Lower California while operating from a skiff. On warm afternoons when the turtles are basking or asleep on the surface of the water, they may be easily speared. During rough seas they remain submerged, only rising to the surface for air. Diving is another means of capture. Turtles are occasionally entrapped within a purse seine set for a school of fish.

Turtles are always delivered alive to the market. In transporting them, they are kept on their backs or they will soon die. The undershell is not rigid enough to support the weight of the animal when out of water and as a result the animal can not breathe properly and soon suffocates.

Choice delicacies are the green turtle products. Those canned are soup, white meat, green meat, and a white and green mixture. From the fat formed on the inside of the back of the animal, oil is derived which is suitable for cooking purposes. The greenish tone in the color of this fat is accountable for the name "green" turtle.—*Katherine Karmelich.*

References (see page 164) : 2, 97.

WHALES

California whaling, which was formerly conducted from several shore stations and at present from a floating plant, is gradually approaching commercial extinction, due to the growing scarcity of whales and because various substances have been substituted for whale products.[1] The shore stations based their fishery mainly on the sperm whale (*Physeter macrocephalus*) and the California grey (*Rhachianectes glaucus*). These species are now very scarce. The present fishery, with the aid of the harpoon gun and small steamers, takes the humpback (*Megaptera versabilis*), the finback (*Balaenoptera velifera*) and the blue whale (*Balaenoptera sulfureus*).—*Paul Bonnot.*

References (see page 164) : 3, 94.

MISCELLANEOUS

The classification "miscellaneous fish" is a necessary evil into which we discard uncertain items. Under this classification we have recorded since 1916 from 60,000 to 1,250,000 pounds of fish per year. We are not presenting a chart of the yearly totals as the fluctuations would indicate nothing more than our success in properly classifying the species in the low years and inability to classify them in the high years. Large quantities of miscellaneous fish would indicate poor

[1] Whale products ranked seventh in volume and fourteenth in value among the fishery products of the state. (See page 140.)

records, lack of cooperation on the part of the dealers, or poor field work on the part of our organization.

The receipt system through which our statistics are gathered originates on the docks, at the receiving depots of the canneries and fresh fish markets. Occasionally the business is transacted and the record is made on a barge or tender at sea. Penmanship is not a particular requirement of a fish buyer and in some instances it is impossible to associate the scrawl on the receipts with any particular species of fish. Occasionally the buyer is unfamiliar with all the species involved in a mixed load and merely calls them "mixed fish." Other times when confronted with a variety of small items, he makes a mental price adjustment, weighs the whole lot as "fish" and lets it go at that.

There are times when items of mixed fish are given as "bait," "flatfish" or "rough fish." We may be familiar with the species that would make up such a load in the port from which the record is received but we would be unable to check the proportion of each species. Unless the amount is of sufficient poundage to warrant contacting the dealer on the subject, it is recorded as "miscellaneous fish."

It is seldom that any of the cannery varieties of fish get into this indefinite classification. The loads are large and usually consist of one species, and where there is a mixture, the prices vary to such an extent that it is to the canners' interest to make the separation in pounds by species. The difficulty comes in the fresh fish markets where there is a large variety of species and where in some cases a flat price per pound is paid for the mixture.

To prevent large quantities of fresh fish from being recorded merely as mixed fish at the receiving depots requires considerable field work. It is necessary for the original records to be checked over in our field offices near the ports of receipt within easy contact of the dealers. A handbook which shows a picture of each fish and its proper common and scientific name has been developed in the educational campaign to overcome the wrong classification of fishes on the receipts and has gone far to prevent unnecessarily large amounts of unidentified fishes from appearing in the miscellaneous classification.

Miscellaneous Fish

Year	*Pounds*	*Year*	*Pounds*
1916	196,786	1926	230,124
1917	256,148	1927	207,443
1918	593,777	1928	196,393
1919	573,241	1929	603,233
1920	259,450	1930	134,299
1921	1,242,180	1931	67,187
1922	254,285	1932	151,167
1923	183,829	1933	148,189
1924	348,488	1934	234,823
1925	230,698	1935	229,546

In addition to the definite item "miscellaneous fish" in our statistical record, we have another type of miscellany which includes fish, shellfish and even reptiles and mammals. Occasionally there enters the commercial fisheries record an item recording a definite species and in sufficient poundage to appear under its own recognizance, although during other years we may have no record. The commercial significance may be slight, but the item is of historic interest. It may be due to the introduction to the public of an unusual sea-food, as in the case of barnacles

and whelks. Occasionally the sale of a species is prohibited by law and the commercial catch is discontinued as has been true of the mussels and sturgeon. Other poundages represent but a small amount of the total harvest, which is due to the fact that the species does not come directly under the supervision of the commercial fisheries laws and the items are accidentally written onto our receipts; in this class we have the frogs. We are giving a short sketch of these individual species which have appeared in the record merely to complete the picture.

Dolphin

Both a fish (*Coryphaena hippurus*) and a mammal have the common name "dolphin" and either might appear in the catch of a commercial fishing boat.

1918	741 pounds
1926	3145 pounds
1931	518 pounds

The fish is taken in southern waters and the 1926 catch is reported from Mexico; and we doubt if the dealers would purchase the mammal so that it is not apt to be included on the receipts.

Eel

1916	50 pounds	1928	227 pounds
1919	10 pounds	1929	327 pounds
1920	180 pounds	1930	20 pounds
1922	20 pounds	1931	226 pounds
1923	188 pounds	1932	242 pounds
1924	56 pounds	1933	103 pounds
1925	246 pounds	1934	23 pounds
1926	238 pounds	1935	96 pounds
1927	5 pounds		

The few pounds of eel reported nearly every year is far from the total catch of eel in the state. In the north two species of blenny (Stichaeidae) enter the commercial catch, usually taken in the paranzella trawls. Neither are true eels. South of Point Conception the commercial eel is the moray (*Gymnothorax mordax*). This is a true eel and is also called conger eel or marina. The lamprey (*Estosphenus tridentatus*) is taken along the entire coast and in a few inland lakes. Although an important item of food among the Indians in northern California, it seldom enters the catch records as this vicious, revolting creature is seldom treasured by commercial fishermen.

California Sea-trout

1919	47 pounds
1920	647 pounds
1921	30 pounds
1922	101 pounds
1923	38 pounds
1925	75 pounds
1935	30 pounds

This relative of the Pacific cultus is not a trout and is seldom even itself when it appears on the commercial fish receipts. In southern California it was an arduous task to prevent the dealers and fishermen from calling the young of the white sea-bass and the shortfin sea-bass "sea-trout," and it has caused considerable confusion in the records. In northern California the steelhead is often miscalled "sea-trout." Small quantities of the true California sea-trout (*Hexagrammos deca-*

grammus) are landed at San Francisco. In addition to this there are two other species of sea-trout found in California waters.

Sturgeon

1916	15,178 pounds
1917	9,822 pounds

Once so abundant in California streams that the flesh was discarded and the roe alone used for caviar. In 1917, when but a few survivors remained in the Sacramento River and San Francisco Bay, the law prohibited both commercial and sport fishing for sturgeon.

Barnacles

In 1916, barnacles entered the record when a chef in one of California's exclusive hotels attempted to introduce this small crustacean as a new attraction for the epicureans. There were 175 pounds of the goose-neck barnacles (*Mitella polymerus*) recorded.

Crayfish

This small crustacean (*Astacus trowbridgei*), which resembles a miniature lobster and is frequently called by its French name "ecrevisse," is taken in considerable quantities in the streams, lakes and reservoirs of the state, but seldom enters the commercial fisheries record. Prior to 1917, large amounts of crayfish were delivered to the San Francisco markets. Our records show the following: 2,478 pounds in 1916 and 210 pounds in 1917.

Limpets

1919	8,350 pounds
1920	18,835 pounds

This small mollusk, which somewhat resembles an abalone, is dried in considerable quantities in Mexico. It is probable that the quantities shown for 1919 and 1920 represent importations from Mexico rather than local landings.

Mussels

1916	53,799 pounds	1926	14,614 pounds
1917	69,042 pounds	1927	29,631 pounds
1918	48,319 pounds	1928	1,610 pounds
1919	35,095 pounds	1929	1,028 pounds
1920	33,112 pounds	1930	325 pounds
1921	9,196 pounds	1931	1,800 pounds
1922	43,872 pounds	1932	230 pounds
1923	60,026 pounds	1933	465 pounds
1924	49,223 pounds	1934	---
1925	25,942 pounds	1935	10 pounds

From a mollusk of considerable commercial importance, mussels (*Mytilus californianus* and *M. edulis*) came into ill repute when through careless gathering of those which had been exposed to the sun and out of water for a period of time several cases of poisoning resulted. At present an ordinance of the California State Board of Health prohibits their sale for human consumption, but quantities are used for bait.

Scallops

1920	759 pounds
1921	1371 pounds

Commercially gathered for two years in the vicinity of Anaheim Landing, Orange County, the supply of this desirable mollusk (*Pecten circularis*) proved insufficient to warrant continued operations. Those sold in the markets at the present time (1935) are shipped from the eastern states and Japan.

Snails

1916	80 pounds	1919	653 pounds
1917	145 pounds	1920	340 pounds
1918	1,461 pounds	1935	600 pounds

The sea snails are a delicacy belonging to the mollusk group. Appreciated by few people, they are of little commercial value and it is doubtful if the bulk of the landings reach our records.

Whelk

This small mollusk was reported for the first time in 1935, with a total of 485 pounds. It is doubtful if these species will ever gain commercial importance.

Porpoise

A mammal, which like the dolphin, is occasionally caught in the fishermen's nets. Although edible and plentiful, they have no commercial value. According to our records, 239 pounds were marketed in 1916.

Frogs

1916	104 pounds	1922	100 pounds
1917	6 pounds	1934	60 pounds
1919	1,312 pounds	1935	20 pounds

Frogs are amphibians and are not regulated by our commercial fisheries laws. They are raised commercially on frog farms and gathered from the marsh lands of the state for commercial purposes, but it is only when handled incidentally to his fish trade that a dealer records them on our receipts. The commercial frogs of the state are *Rana sp.* Quantities are imported from Louisiana and Texas for the restaurant trade of the state.

Terrapin

1916	3,216 pounds	1922	360 pounds
1917	9,456 pounds	1923	1,128 pounds
1918	648 pounds	1924	312 pounds
1919	4,272 pounds	1928	168 pounds
1920	144 pounds	1930	58 pounds
1921	120 pounds	1931	624 pounds

Terrapin are caught in inland waters. Our records show only a small part of this reptile catch, most of which is handled by dealers not in the regular fish business.—*Geraldine Conner.*

References (see page 164) : 98, 102.

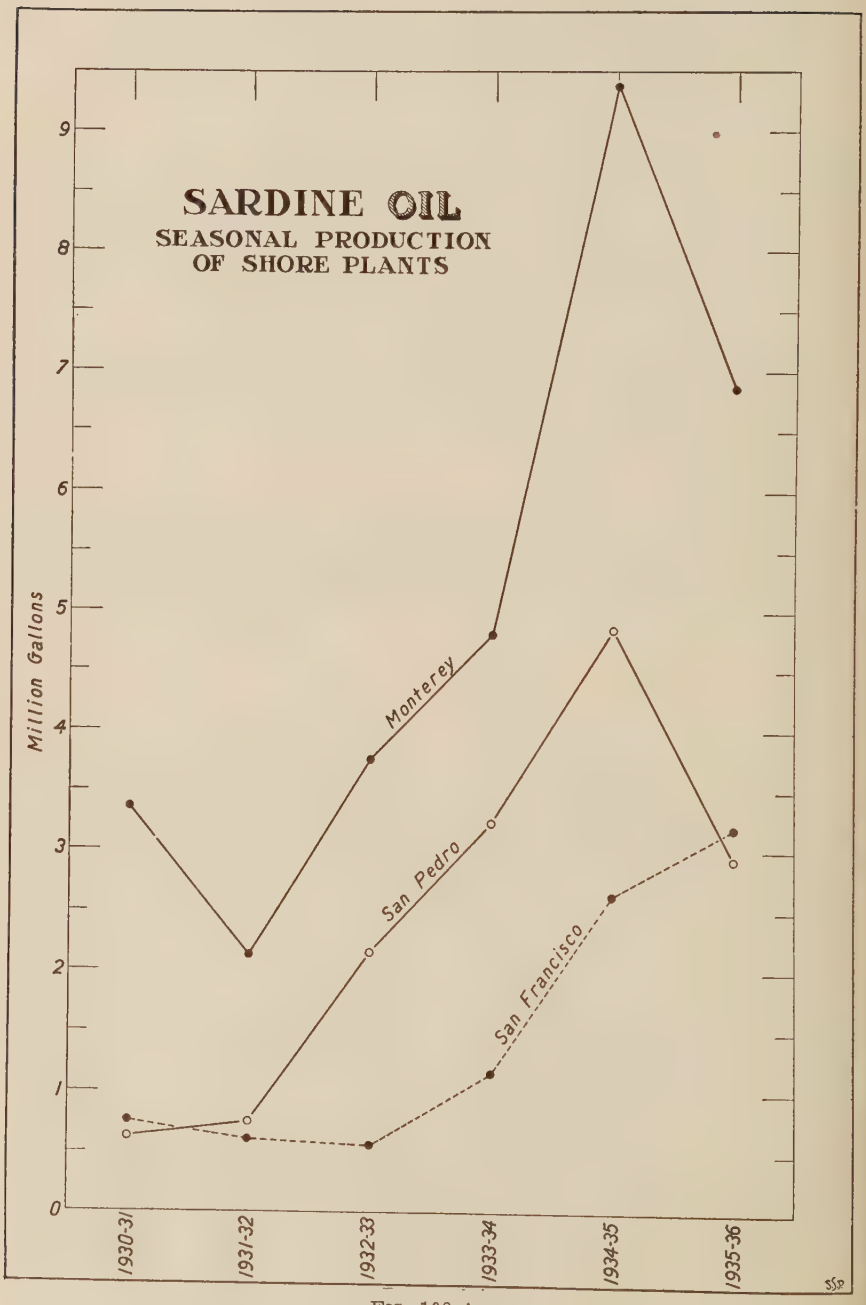
SARDINE OIL
SEASONAL PRODUCTION
OF SHORE PLANTS
Million Gallons
0
1
2
3
4
5
6
7
8
9
Monterey
San Pedro
San Francisco
1930-31
1931-32
1932-33
1933-34
1934-35
1935-36

FIG. 108-A.

SARDINE OIL AND MEAL PRODUCTION

With the growth of the California sardine fishery, the reduction of sardines into oil and meal has become an important phase of this industry due in part to the increased prices and market demand for these by-products. In addition, the Division of Fish and Game granted liberal permits to use this food fish for reduction purposes during the last few years of economic depression in order to assist the fishing industry as a whole and make for more employment among the fishermen and cannery workers. One result has been the establishment of new shore plants and reduction ships at sea beyond the jurisdiction of the state and the enlargement in output capacity of those already in operation. During the season of 1934–35, the sardine oil production by the California shore plants reached a total of over 16,800,000 gallons.[1] For the same season, the estimated gallonage for the "floaters" was in excess of 5,358,000, making a seasonal total of about 22,000,000 gallons. The next season the land plants in California produced 13,200,000 gallons of oil and the floaters an estimated 7,826,000 gallons, or a total from all sources of approximately 21,000,000 gallons.

Sardine meal production, like oil, reached its peak in the season of 1934–35 when the combined state total of shore plants was 77,600 tons. The same season the floating plants produced an estimated tonnage of 22,400, making a combined total of about 100,000 tons. The following season, 1935–36, the shore plant production declined to 59,900 tons and there was a slight increase of the floaters' tonnage to 27,300, or a total of 87,200 tons.

Both oil and meal production at the three principal ports follows the same general trends. Although the San Francisco production is the lowest, it gradually has increased over the period of six seasons due to the increased number of operating units. Monterey shows the greatest production for both oil and meal, with San Pedro closely following in amounts and in the seasons of high and low production. (See Figs. 108A and 108B.)

NORMAL SEASONAL YIELD PER TON

Gallons of Oil per Ton of Sardines

As people in the industry know, there is great fluctuation in the oil yield per ton of sardines from month to month in any one season, and variations are apparent from season to season and between localities for the same months and seasons. In a comparison of the number of gallons of oil produced per ton during one season, month by month, with the yield of another season, there appears to be no rhyme or reason to the great fluctuations. However, if we combine, say, records for six

[1] Sources of data on the production for the seasons 1930–31 to 1935–36 can be found in the Division's circulars, numbers 5–10, "Statistical reports on fresh and canned fishery products," by S. H. Dado.

seasons and average the oil yield (gallons per ton of fish) for corresponding months, we can determine a normal seasonal yield.[2]

The normal seasonal yield of oil per ton of raw sardines at San Francisco, Monterey and San Pedro is shown in figure 108C. Monterey

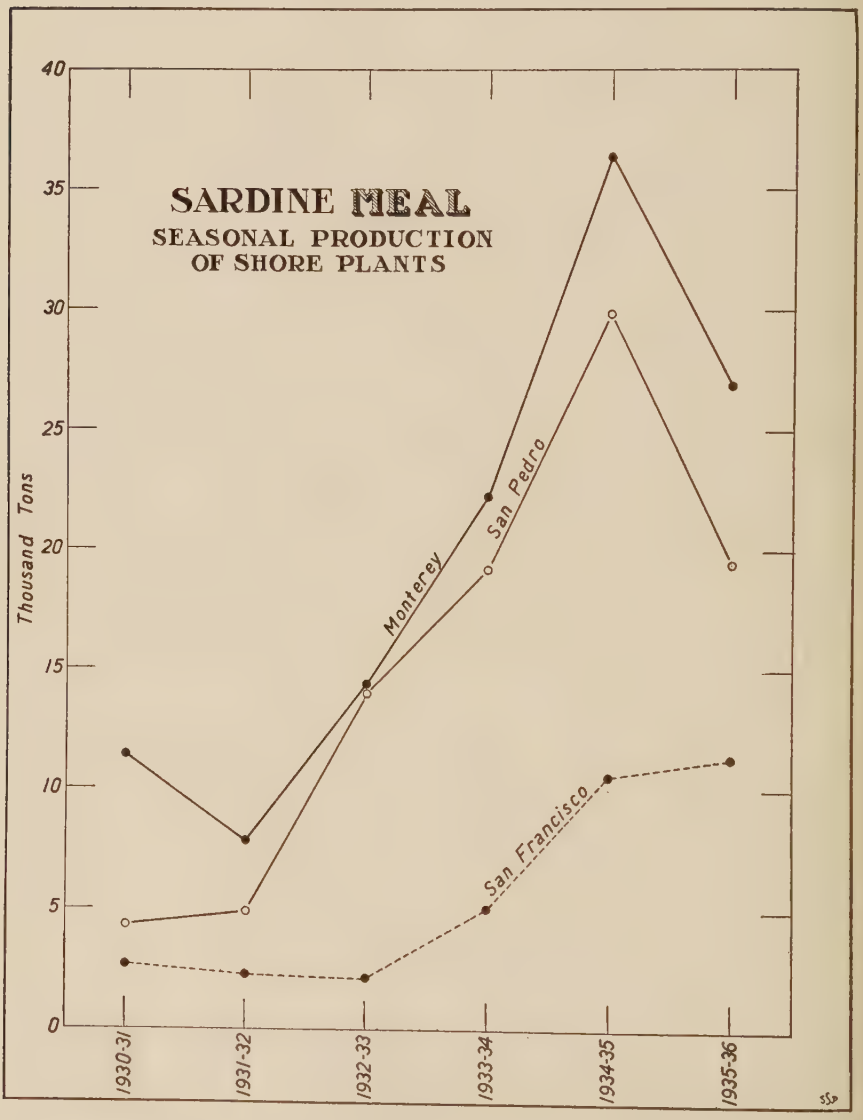

FIG. 108-B

and San Francisco follow each other closely—the months of highest yield being September (44 to 46 gallons per ton) and October (44 to

[2] Averages were obtained by adding up the tons of offal and the tons of whole sardines, used in making meal, for all Augusts, all Septembers, etc., for six seasons. Likewise the gallons of oil produced for the months in the six seasons were totaled and then the gallons per ton calculated from these totals for a normal yield for August, September, etc.

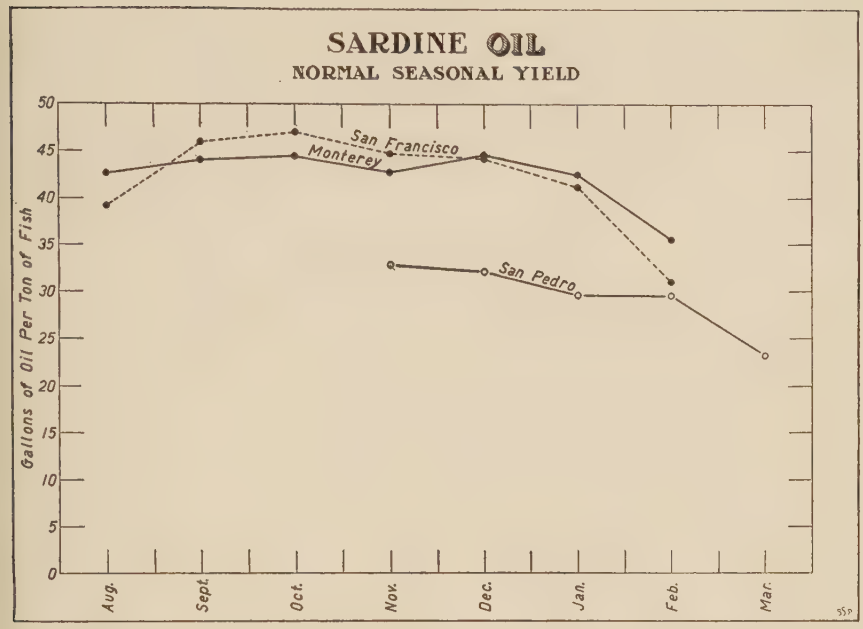

FIG. 108-C. Normal seasonal yield, gallons of oil per ton of fish used in the reduction plants. Seven season average, August through November; six season average, December through March.

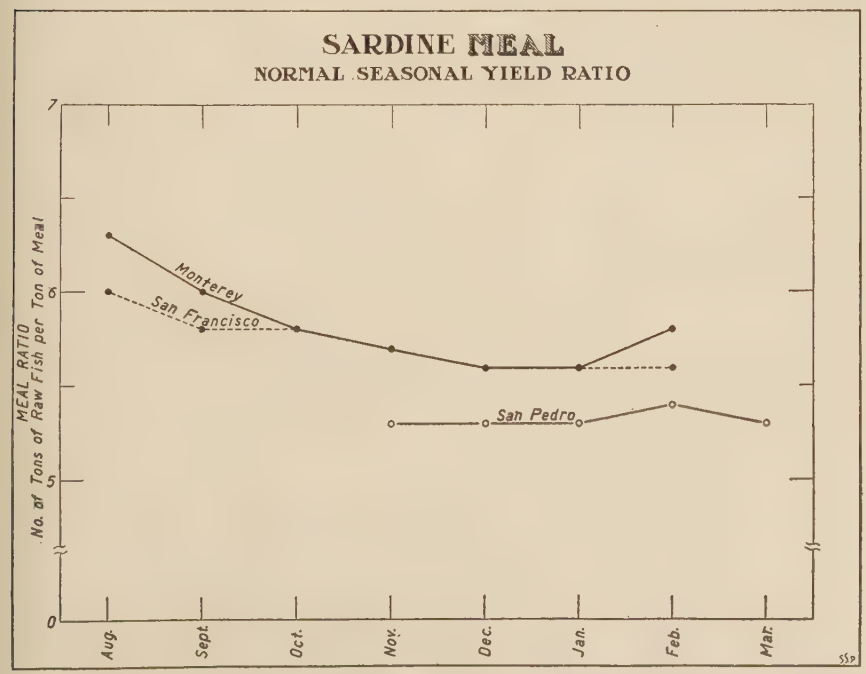

FIG. 108-D. Normal seasonal yield ratio, tons of raw fish per ton of meal produced. Seven season average, August through November; six season average, December through March.

47 gallons per ton). As the season advances, the yield drops to a low in February (31 to 36 gallons per ton). Although San Francisco has a higher yield four months out of the season, Monterey exceeds it in August, January and February. San Pedro on the other hand starts high (although the yield, 32.9, is much lower than the other ports) in November and declines throughout the season to a low in March of 23.1

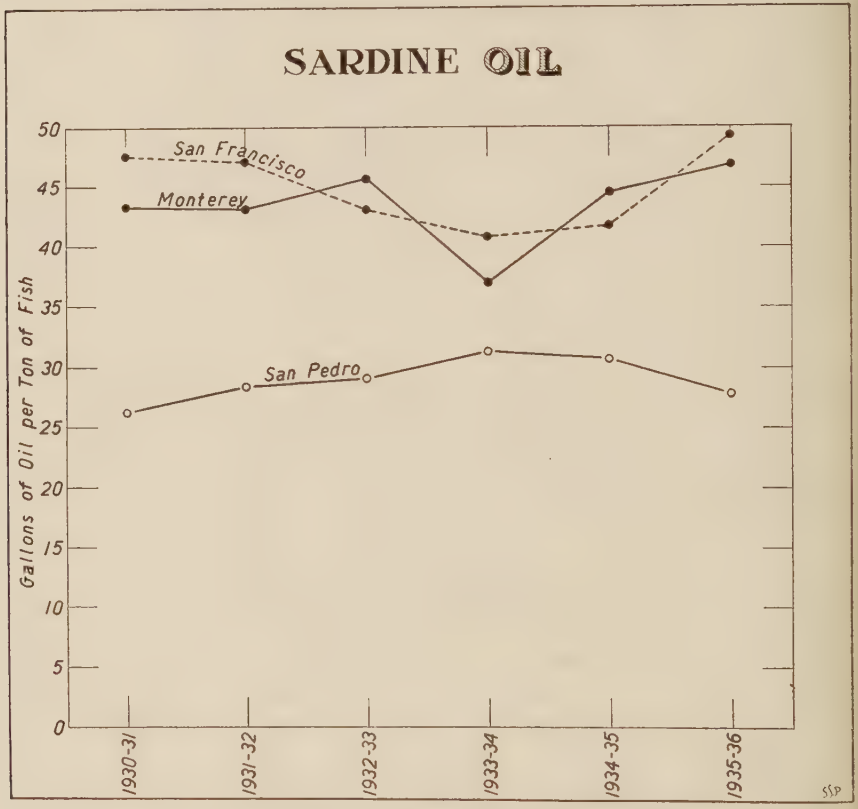

FIG. 108-E. Gallons of oil per ton of fish each season.

gallons per ton. (See Fig. 108C). These normal seasonal yields are what may be expected to occur each season as to months of high and low yield although great variations from the normal will occur in individual months from season to season.

Normal Seasonal Meal Ratio

The normal seasonal meal ratio,[3] or the number of tons of raw sardines used to produce a ton of meal, is shown in figure 108D. This ratio is based on a six seasons' average. Here again the trends for Monterey and San Francisco follow each other except during the beginning and end of the normal season. Variations from month to month or between ports, of course, are very small in actual figures, being only in tenths. However, in any amount of tonnage even a difference of one-

[3] Meal ratios were calculated by the same method used for gallons of oil per ton of fish. See footnote 2.

tenth will materially affect the production. In the meal ratio, a high ratio means that it takes more raw fish to produce a ton of meal, so the low ratios indicate better production. For San Francisco and Monterey the best production comes as the season advances except in February for Monterey. However, for San Pedro the ratio is the same (5.3) for all months except in February when it increases to 5.4. These normal seasonal ratios should show the industry at the various ports what is to be expected in meal ratio for any season, although individual seasons will vary from this normal.

Season to Season Fluctuations

Besides the normal monthly variations of the yield of gallons of oil per ton within each season, there are of course fluctuations in the

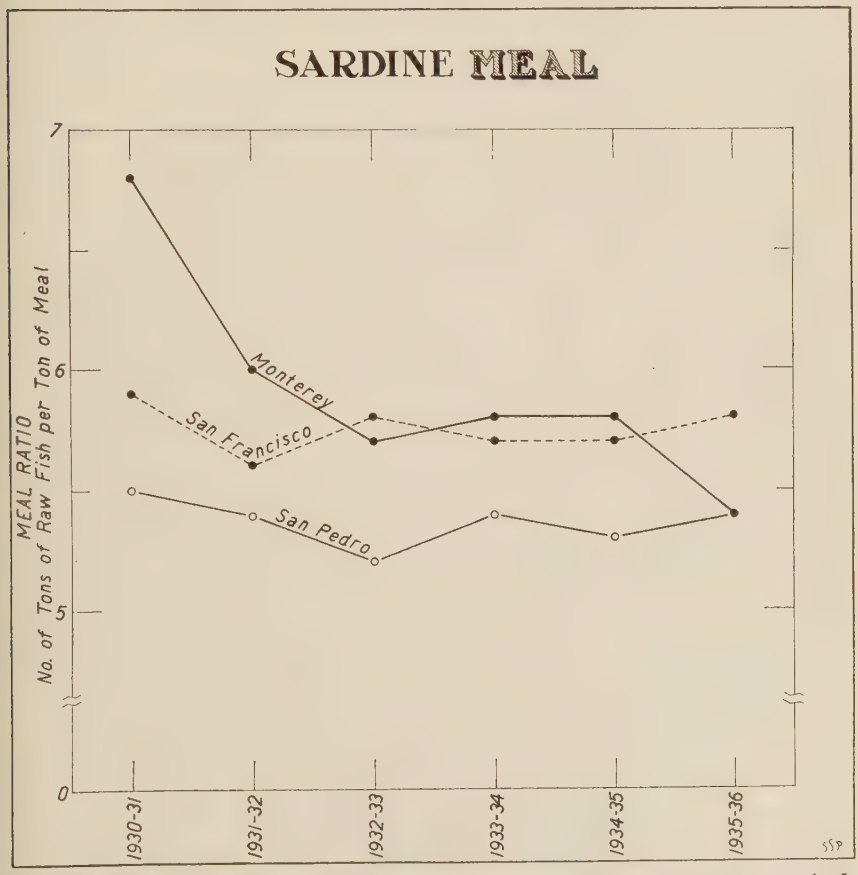

Fig. 108-F. Sardine meal ratio showing number of tons of raw fish required to produce one ton of meal. Seasons 1930-1931 through 1935-1936.

yield from one season to another. Figure 108E shows the oil yield for the seasons 1930–31 to and including 1935–36 for San Francisco, Monterey and San Pedro. Again the San Francisco and Monterey yields are very much alike in relation to high and low points except for the season of 1932-33. The curves (Fig. 108E) are high at the beginning,

lowest in 1933–34 and again high in 1935–36. San Pedro on the other hand is almost the opposite, being high in 1933–34 and low in 1930–31 and 1935–36.

In Figure 108F are shown the meal ratios for the seasons 1930-31 to 1935-36. These seasonal ratios are extremely steady, there being little change over the period except for Monterey in 1930-31 and 1935–36.—*G. H. Clark.*

FISH LIVERS

Medicinal oil produced from fish livers has recently come to the front as one of the most important by-products of California's fishing industry. Not so many years ago, the only liver oil of any consequence was cod liver oil, produced from the codfish of the North Atlantic. Then came the discovery of the high vitamin content of halibut liver oil, and the consequent advertising of its potency has brought the halibut of the North Pacific into the limelight. More recent research has established the medicinal value of the oils produced from the livers of many other fishes. Furthermore, scientists have shown the value of blending oils from certain species. This results in a product high in both vitamin A and D content, one of which is usually lacking in the oil from any one species of fish.

As a result of these discoveries and the widespread publicity given them by the various pharmaceutical concerns, the fish liver oil business has boomed in California as elsewhere. The five-gallon liver can has become standard equipment in nearly every fish cannery and market along our coast. Fish cleaners use the cans as depositories for the livers they remove from many kinds of fish. The rendering plants at Seattle, Washington, and San Diego maintain a regular scheduled pick-up service so that the full cans have no chance to accumulate.

Cannery men save the livers from all species of tuna and from yellowtail, mackerel and horse mackerel. In all cases the sale of the livers defrays the entire cost of cleaning the fish, which means just that much more profit to the packer when he sells his canned fish.

Wholesale market men likewise realize a good profit from the sale of livers. They save the livers from sablefish, rockfish, sea-bass, mackerel, halibut and many other species. The sablefish has a particularly desirable liver, the utilization of which has been a contributing factor to the rapid expansion of the fishery for that species. The markets also handle swordfish livers. These are sold to them separately by the fishermen who clean their fish at sea.

During 1934 and part of 1935, the manufacturers of medicinal oils were more or less indiscriminate in their purchases of fish livers, buying any and all obtainable. Studies on the products obtained from all these livers showed that certain fish livers yielded more desirable kinds of oils than others. As a consequence, market men were given a rude shock when told not to save certain livers any more. Some minor species are not used at all and purchases of mackerel livers have dropped sharply.

In addition to utilizing fish livers from local sources, the Pacific Coast rendering plants also import quantities from Japan.—*Richard S. Croker.*

SEAWEED AND KELP

The seaweed and kelp industry is divided into two distinct phases. For human consumption a littoral algae (*Porphyra perforata*) is gathered, dried and exported to China. This species is found along the coast from Point Conception northward. The larger kelps (*Macrocystis pyrifera* and *Nereocystis Luetkeana*) are harvested in southern California and processed to produce chemicals, *e.g.*, iodine, acetone, and for fertilizer and stock feed. Agar-agar has been produced also in small quantities from local species of *Gelidium* and *Graciliara*. There are about 15 species of algae in southern California waters which are suitable for the manufacture of agar-agar.

References (see page 164): 6, 47, 74, 78, 81, 89.

FIG. 109. Kelp harvester at work off Los Angeles Harbor. The cutters are a few feet below the surface and the moving track carries the cut kelp on board. April 7, 1936.

THE VALUE OF THE COMMERCIAL FISHERY PRODUCTS OF CALIFORNIA

The fisheries of California not only yield an enormous volume of fishery products but these products rank exceedingly high in value [1] as compared with other states of the Union and the Territory of Alaska.

A comparison of the annual average catch and value of fishery products by states and territories reveals that in the five-year period 1929–1933, California was the leading producer and was exceeded only by Massachusetts and Alaska in value of these products.

In considering the economic conditions of the 1931–1933 period in the United States and their effect upon the fishing industry, it is noted that the production of the major fisheries was maintained very favorably at a high level and the decline in value was due largely to lower prices paid for the fish in most sections of the country. However, in California, not only did the average price of fishery products decline heavily but the fishes (tunas, sardines and mackerel) used primarily for canning and manufacturing purposes also suffered a heavy drop in catch. The combination of these two factors resulted in a much greater drop in the total value of fishery products than in most other parts of the country. Thus the gross income to the California fishermen was more seriously affected than in other areas. Also, the extent of employment which the fisheries create in allied industries was more seriously affected. The decrease in total catch reduced the number of days of employment afforded in the canneries and manufacturing plants, less canning equipment and supplies were used, and shipping of fishery products was likewise affected. The extremely low income of the fishermen did not permit of maintenance and replacement of fishing vessels and gear, thus curtailing activities in California's numerous shipyards during most of this period.

The value of the fishery products landed in California in the ten-year period of 1926–1935, and a comparison of the value of the catch taken in waters north and south of an extension of the boundary between the United States and Mexico are given in figure 110. Of the amount reported from north of this boundary, all the fish are taken off the California coast except for a small quantity caught off the southern Oregon coast and also the Bering Sea cod brought to California to be packed.

[1] These compilations are intended to represent only the fisheries prosecuted by residents of the United States, and do not include imports from foreign countries when such imports are not the product of American fishermen. Also, they do not include the value of sardines delivered to floating reduction plants operating outside the state's jurisdiction, but do include the value of the Alaska cod and whale products which are not customarily included in the statistics published by the California Division of Fish and Game. The valuations are based on the sale price of the fishery products as landed at the docks by the fishermen. These values, as presented in this article, are preliminary compilations and may be subject to some minor corrections and revisions, but are sufficiently accurate to represent the trends. The data have been compiled chiefly from records collected by the Bureau of Commercial Fisheries of the California Division of Fish and Game.

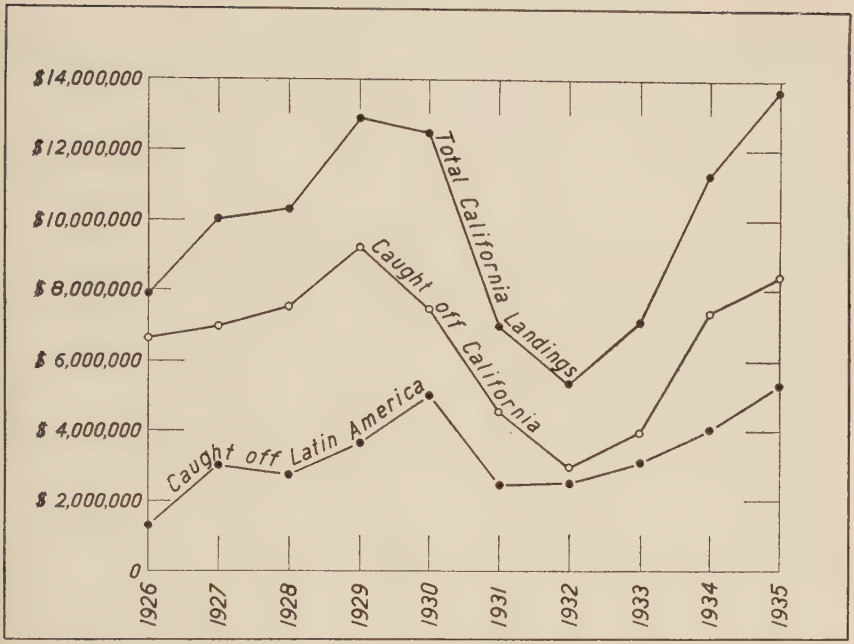

FIG. 110. Total value of fishery products landed in California from 1926 through 1935. Compared with catch from waters north and south of an extension of the boundary between the United States and Mexico.

FIG. 111. Annual values of tuna, sardine, mackerel and "other fishery products" landed in California from 1926 through 1935.

The five tunas (yellowfin, bluefin, skipjack, albacore and bonito) and yellowtail are used primarily in the canning industry to produce the pack of tuna and tuna-like fishes and are here termed the "tunas." The tunas, sardines and mackerel accounted for over 75 per cent of the total valuation of fishery products in California in 1935. A comparison of the value of each of these three major fisheries and the value of all "other fishery products" is shown in figure 111. It may be noted from this graph that these three major products determined largely the trend of the total value of the fishery products throughout the period under consideration. The "other fishery products," consisting largely of fish and shellfish used in the fresh fish trade, did not decline as sharply in the 1931–1933 period and neither has this group

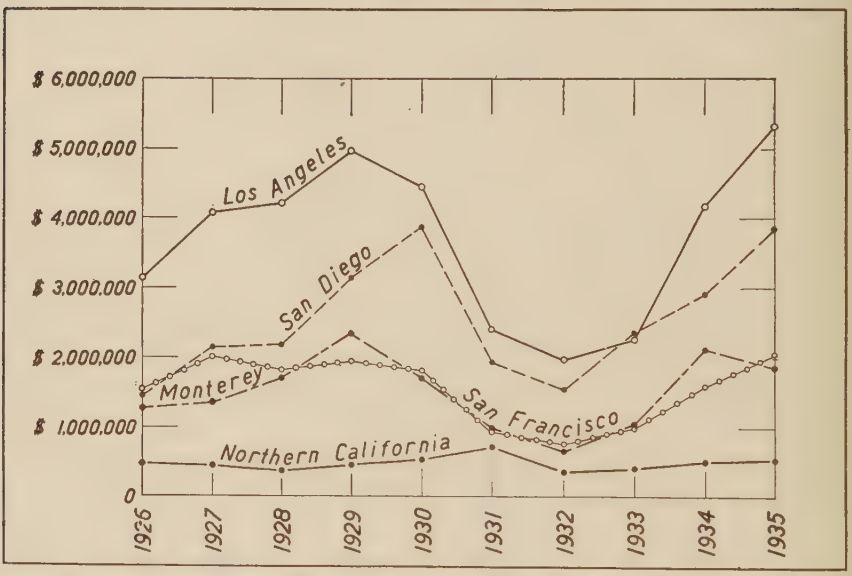

FIG. 112. Annual values of fisheries products of the five major geographical districts of the state from 1926 through 1935.

improved as rapidly in 1934 and 1935. The tunas, sardines and mackerel declined quite heavily in both catch and average price, thus accentuating the decline in total value of these species in 1931–1933. Although the average prices of tunas, sardines and mackerel have not risen to their former height of 1929–1930, a greater volume has served to bring their total value near to or even greater than the earlier peak records.

The trend of the total value of the catch of the fisheries in the five major geographical divisions [2] of the state, is shown in figure 112. It is noted that the trend of the San Diego district is very closely correlated

[2] The United States Bureau of Fisheries divides the State of California into five geographical districts instead of the eight regional divisions used by the Division of Fish and Game of California. These five districts are formed as follows: Regions 10 and 20 of the state are combined to form the "northern district"; regions 30 and 40 are combined to form the "San Francisco district"; regions 60 and 70 the "San Pedro district"; region 50 is the "Monterey district"; and region 80 is the "San Diego district". Refer to figure 1 for map showing the regional divisions as used by the Division of Fish and Game of California.

with that of the tunas, due to the fact that the value of the catch of the tunas contribute the major portion to the income from the fisheries of this district. The San Pedro district, where the bulk of the mackerel and a goodly share of the sardines, tunas and other fishery products are taken, follows closely the state-wide trend. In the Monterey district, the trend is almost identical with that of sardines; this species generally accounts for over 75 per cent of the fisheries income in this district. The trend of the San Francisco and northern districts, if combined, would follow fairly closely the trend of "other fishery products," except during the past few years when it was influenced by a rapid expansion of the sardine industry in this area.

In the accompanying table are presented the 35 major fishery products of California in order of importance on the basis of volume and the 35 leading products on the basis of value. (The figures have been rounded off to the nearest thousand pounds or dollars.) In volume the 35 products constitute 99.7 per cent of the state's entire production, and in value the products listed comprise 97.9 per cent of the entire value for California. Thirty-two of the same products appear under poundage and value. Some of these species may appear insignificant, yet to certain fishermen the species of less importance provide a living just as adequately as the major species of tunas, sardines and mackerel do for a relatively larger number of fishermen.

Among the economic phases, it may be pointed out that the income which the fishermen derive from their efforts is but a small part of the total contribution to the economic welfare of our people which results from the exploitation of our aquatic resources. Our fishery harvest supplies many economic values, some of which can not be estimated in terms of dollars. The income from employment in the canneries, wholesale and retail establishments and in allied industries, such as boat building and repairing, marine supply houses, can manufacturing, transportation, etc., far exceeds the income of the fishermen.—*C. B. Tendick, Agent, U. S. Bureau of Fisheries.*

MAJOR FISHERY PRODUCTS OF CALIFORNIA IN 1935 BY VOLUME* AND VALUE

	Volume expressed in thousands of pounds		*Value expressed in thousands of dollars*
1. Sardines	829,513	1. Yellowfin tuna	3,620
2. Pacific mackerel	146,427	2. Sardines	3,230
3. Yellowfin tuna	72,252	3. Bluefin tuna	1,145
4. Bluefin tuna	25,173	4. Pacific mackerel	1,020
5. Skipjack or striped tuna	17,197	5. Skipjack or striped tuna	688
6. Horse mackerel	9,984	6. Sole	499
7. Sole	9,164	7. Crabs	377
8. Yellowtail	8,149	8. Salmon	347
9. Bonito	7,896	9. Yellowtail	234
10. Whale products	5,724	10. Bonito	229
11. Salmon	5,656	11. Spiny lobster	213
12. Alaska cod	5,102	12. Albacore	200
13. Rockfish	4,828	13. Rockfish	180
14. Abalone	3,871	14. Whale products	155
15. Crabs	3,693	15. California halibut	115
16. Shrimp	3,447	16. Abalone	115
17. Sablefish	2,834	17. Barracuda	111
18. Barracuda	2,618	18. Oysters	98
19. Albacore	2,448	19. Sablefish	85
20. Shad	1,602	20. Swordfish	74
21. California halibut	1,576	21. Alaska cod	72
22. Flounder and sand dab	1,404	22. White sea-bass	66
23. Spiny lobster	1,345	23. Northern halibut	62
24. White sea-bass	1,070	24. Flounder and sand dab	62
25. Smelt and whitebait	1,045	25. Shrimp	53
26. Pacific cultus or "lingcod"	1,011	26. Smelt and whitebait	49
27. Pacific herring	929	27. Shad	45
28. Northern halibut	870	28. Horse mackerel	43
29. Squid	816	29. Striped bass	41
30. Kingfish	769	30. Pacific cultus or "lingcod"	39
31. Swordfish	669	31. Black sea-bass	34
32. Oysters	669	32. Catfish	32
33. Black sea-bass	631	33. Clams	29
34. Sharks and grayfish	555	34. Squid	23
35. Striped bass	502	35. Rock bass	21

* The poundage of dry salt cod landed in California has been converted to its approximate equivalent in round weight of fresh cod in order that it may be shown on a comparable basis with other species. (See article on Alaska cod in this bulletin.) The poundages shown in this table do not include importations which are not the product of American fishermen, so will not agree in some instances with the poundages shown in other parts of this publication, which include such foreign importations; nor do they include sardines delivered to floating reduction plants.

C. B. Tendick, Agent, U. S. Bureau of Fisheries.

COMMERCIAL FISHING FLEET

There has been a tendency toward larger boats in the commercial fishing fleet and for the past few years boats entering the fisheries have been of considerable size. In southern California many new boats were built which was the natural consequence of several successful seasons and they were larger to suit the requirements of the longer voyages necessary in the tuna fishery. At San Francisco, the development of the sardine industry attracted larger boats to operate both for the new land plants and the floating reduction ships. To meet this exigency, boats were built and more than the usual number of larger boats from Oregon, Washington and Alaska were attracted to California waters to try their luck at between-season fishing.

COMMERCIAL FISHING FLEET, 1935

Regions of home ports	Number of boats grouped by length in feet					Total number of boats in each region
	Up to 24 feet	25 feet to 39 feet	40 feet to 64 feet	65 feet to 84 feet	85 feet and over	
Oregon, Washington and Alaska boats fishing in California	0	23	36	54	1	114
Del Norte	3	15	2	0	0	20
Eureka	18	149	18	0	0	185
Sacramento	116	140	0	1	0	257
San Francisco	47	364	35	18	2	466
Monterey	99	176	45	21	0	341
Santa Barbara	46	46	19	0	0	111
Los Angeles	164	308	146	74	26	718
San Diego	29	105	59	13	35	241
Total number of boats in each length group	522	1,326	360	181	64	2,453

In 1935 there was a general increase in numbers of all sizes of boats which actively participated in fishing; this increase was 15 per cent over the total figure for 1934. In checking over the figures for the previous year (Fish Bulletin 44, page 30) an explanation of the increase is quite obvious. There were 22 additional boats from the northern states and Alaska, which came south. At San Francisco there was the increase in the number of larger boats due to the sardine fishery development. At Los Angeles an unexpected run of albacore brought into action many of the older, smaller boats which had been tied to the moorings for years and pleasure fishing craft owners were encouraged to enter the commercial field for this profitable fishing so close at hand. However, the 30 per cent increase in the number of boats over 65 feet in length would far outbalance in value and fishing ability the 46 per cent increase in the number of those under 40 feet in length.—*Geraldine Conner.*

References (see page 164): 41, 70.

FIG. 113. Fishermen aloft watching for schools of fish. Photo by R. S. Croker, June, 1933.

COMMERCIAL FISHERMEN

The California commercial fisherman represents a fusion of many races and the gear which he uses and the methods he practices bespeak the country of his nativity. The native born citizens of the United States who follow California's fishing fleet represent but one-third of the commercial fishermen. Although the greater portion of the balance may be naturalized citizens, they give a foreign country as their place of birth on the commercial fishing license application. (See Figs. 113 and 114.)

We present a chart of the nativity of the fishermen for the license year 1935–1936. In addition to the predominant nationalities recorded on this chart there were scattered representatives of other

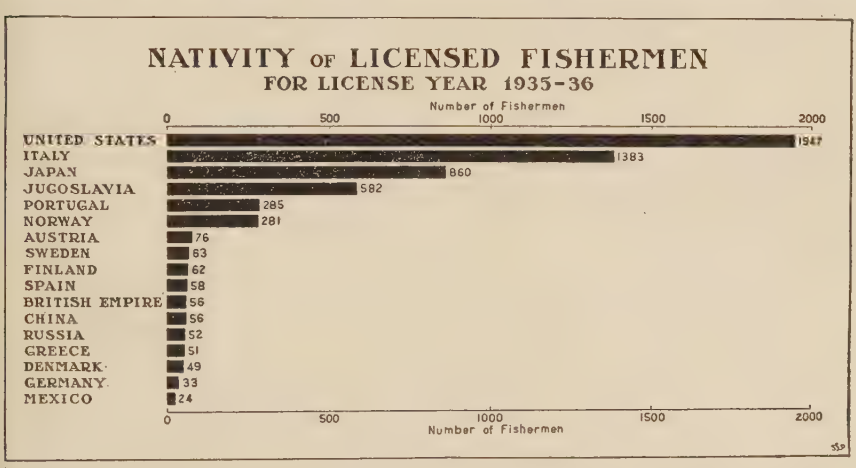

FIG. 114. It is possible the bulk of the fishermen giving "Austria" as their native land should be grouped with those from Jugoslavia since the older men are most apt to be southern Slavs born during Austria's rule, with few true Austrians of German extraction among them.

nations, totaling 89 fishermen, recorded in our tabulations, making a total number of 6007 licensed fishermen for the year.

There is quite a marked separation of races with concentrations of one nationality or another at each port. We have noted the nationalities in order of their importance for each of the statistical regions of the state. In some instances the numbers of individuals may seem small but they represent the bulk of the fishermen of one particular nationality in the state; for example, 51 of the 56 Chinese recorded operate in and about San Francisco. Most of the Finns are at Eureka, the Greeks in the Sacramento River region, the Russians at San Pedro and the Portuguese at San Diego.

LICENSED FISHERMEN IN CALIFORNIA—LICENSE YEAR, 1935–36

Region	*Nativity*	*Number*
Region 10, Del Norte	United States	15
Region 20, Eureka	United States	75
	Finland	34
Region 30, Sacramento	United States	170
	Italy	153
	Greece	31
Region 40, San Francisco	Italy	391
	United States	245
	Norway	59
	China	51
Region 50, Monterey	Italy	449
	United States	335
	Japan	117
	Spain	45
Region 60, Santa Barbara	United States	132
	Italy	13
Region 70, Los Angeles	Japan	592
	United States	576
	Jugoslavia	526
	Italy	167
	Norway	55
	Russia	35
Region 80, San Diego	United States	323
	Portugal	223
	Italy	201
	Japan	131
	Sweden	23

The records show that 209 commercial fishermen from Oregon, Washington and Alaska came south during the 1935–1936 license year and secured California commercial fishing licenses. Ten nationalities were represented among these migrants from the north, the more important among them being:

Norway	94 fishermen
United States	49 fishermen
Jugoslavia	30 fishermen
Austria	17 fishermen
Finland	12 fishermen

License fees were first collected from market fishermen in 1887. In 1909 the fisherman was first required to give a detailed description of himself, the name of the boat upon which he fished or the type of fishing he pursued, and to give his address. The information concerning the nativity of the fishermen has been tabulated from the commercial fishermen's license applications. The present license year runs from April 1st of one year through March 31st of the following year. The license fee is $10 per year for each fisherman. The following is a record of the number of fishermen licensed by the state for the past twenty years.—*Geraldine Conner.*

Licensed Commercial Fishermen

License Year	*No. of Fishermen*	*License Year*	*No. of Fishermen*
1916–17	2663	1926–27	5078
1917–18	2152	1927–28	5206
1918–19	4522	1928–29	5340
1919–20	5087	1929–30	6014
1920–21	5269	1930–31	6179
1921–22	4462	1931–32	5651
1922–23	4472	1932–33	4955
1923–24	4123	1933–34	4991
1924–25	4671	1934–35	5323
1925–26	5072	1935–36	6007

NOTES ON TABLES OF FISH LANDINGS

Regions. (See Fig. 1.)

The California fish catch statistics were segregated into areas of the state as determined by county lines. This was not the best possible method and it seemed more logical to divide the state into eight regions, each one of which would be a geographical unit determined so far as possible by uniformity in fishing and marketing conditions. Beginning with 1931, the catch records have been handled on this basis of eight geographical marketing regions. These represent land areas where fish are delivered and sold. For this reason, the tables are called "tables of landings." The eight geographical regions of the state are as follows:

Region 10. Del Norte. The coast line from the Oregon-California boundary line southward to Trinidad Head (Humboldt County).

Region 20. Eureka. From Trinidad Head to Point Arena.

Region 30. Sacramento. The Sacramento and San Joaquin river systems with the delta areas, including San Pablo and Suisun bays. Lake County is also included.

Region 40. San Francisco. The coast from Point Arena to Pigeon Point and the San Francisco Bay area up to Carquinez Straits.

Region 50. Monterey. From Pigeon Point to Point Piedras Blancas (San Luis Obispo County).

Region 60. Santa Barbara. From Point Piedras Blancas to Point Dume (Los Angeles County).

Region 70. Los Angeles. From Point Dume to San Mateo Point.

Region 80. San Diego. From San Mateo Point to the boundary line of Mexico, including Salton Sea.

10—40339

LANDINGS—REGION 10, DEL NORTE, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Anchovy						22							22
Cultus, Pacific	61	1,662	1,555	1,992	332	185	1,493	1,885	2,164	7,483	6,841	935	26,588
Halibut, Northern			505	400	662	358	702	693	754	1,755			5,829
Herring, Pacific	338	8											346
Perch				44									44
Rockfish	466	611	1,403	1,145	559	817	269	432	2,341	14,468	2,815	1,692	27,018
Sablefish				18	436	125	36	28	329	636	98		1,706
Salmon				12	7,959	5,866	46,925	128,048	29,088				217,898
Smelt							238						238
Sole							5	10	40	44			99
Whitebait	6,763	5,971	8,728	6,430	1,890	2,155	1,130						33,067
Crustacean:													
Crab	136	470	1,208	1,094	1,724	3,128	906	494				580	9,740
Mollusk:													
Clam							34						34
Clam, Razor							40						40
Clam, Washington											33		33
Total pounds	7,764	8,722	13,399	11,135	13,562	12,656	51,778	131,590	34,716	24,386	9,787	3,207	322,702

LANDINGS—REGION 20, EUREKA, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Cultus, Pacific	4,315	31,038	20,266	30,931	4,272	7,675	29,766	24,654	23,758	32,956	40,022	6,423	256,076
Flounder, Starry	4,296	1,673	1,345								757	547	8,618
Halibut, Northern			15,918	91,679	158,767	85,933	172,933	83,453	58,922	83,484	4,853		755,942
Herring, Pacific	4,281	2,500							4,405			508	11,694
Mackerel, Pacific									7				7
Perch	267	2,150	3,641	3,157							338	79	9,632
Rockfish	3,631	6,235	9,123	18,390	7,568	5,500	21,177	13,524	13,552	15,446	14,747	4,410	133,303
Sablefish	8,178	8,830	26,162	17,812	111,750	24,380	78,515	210,116	250,465	226,901	70,193	7,515	1,040,817
Salmon				170,560	244,442	82,999	841,186	1,128,102	814,423				3,281,712
Sand Dab		50											50
Sea-trout		25											25
Smelt	3,063	2,672	301	62		1,196	3,372	1,474	1,579	3,704	2,464	4,645	24,532
Sole	455	363	85			127		7				50	1,087
Tuna, Albacore							19						19
Whitebait	4,474	8,802	7,739	11,816	17,524	18,875	13,983	5,570	80				88,863
Miscellaneous Fish	57	106	764	696	5,974	67	5,790	96	57	478	2,592	641	17,318
Crustacean:													
Crab	18,306	16,874	15,584	10,020	14,042	15,732	24,468	23,952				7,800	146,778
Mollusk:													
Clam, Cockle									369	221	54	109	753
Clam, Gaper	384	408	768	504									2,064
Clam, Washington	3,492	4,657	5,922	1,996					7,102	7,350	5,195	4,515	40,229
Octopus	83	87	1,026	238						54	279		1,767
Total pounds	55,282	86,470	108,644	357,861	564,339	242,484	1,191,209	1,490,948	1,174,719	370,594	141,494	37,242	5,821,286

LANDINGS—REGION 30, SACRAMENTO, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Carp	13,667	13,824	19,547	16,384	6,857	6,931	5,475	742	303	132	7,124	13,176	104,162
Catfish	8,922	7,817	25,425	35,332	436	597	508	1,623	56,362	68,757	50,122	33,723	289,624
Flounder, Starry		150											150
Hardhead	11,371	8,749	12,270	13,103	8,200	6,200	1,425		18	3,580	5,379	7,749	78,044
Pike	39	329	736	444	10			42	12	19			1,631
Salmon	2,058	9,498	8,588	24,881	61,878	19,977		167,080	594,003		495	410	888,868
Sardine	15,340,299	2,961,800						2,735,900	14,596,400	20,637,800	33,584,900	20,608,200	110,465,299
Shad		2,341	87,404	795,779	716,505								1,602,029
Split-tail	9,042	6,615	5,830	3,152	1,650	1,327	180	579	945	309	2,649	5,287	37,565
Striped Bass		54,065	113,886	225,941	76,950								470,842
Sucker	7,467	4,915	7,569	3,021	2,075	2,275	1,100			17	5,805	10,124	44,368
Miscellaneous Fish		35	98		500	700	600			22	20	24	1,999
Total pounds	15,392,865	3,070,138	281,353	1,118,037	875,061	38,007	9,288	2,905,966	15,248,043	20,710,636	33,656,494	20,678,693	113,984,581

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Anchovy			2,050	10,450		3,775	16,400	14,200	21,800	5,225		650	74,550
Cabezone			200							200			400
Cultus, Pacific	20,602	36,738	59,901	47,644	37,048	74,278	73,865	70,695	75,926	74,451	42,844	13,389	627,381
Eel				20				5					25
Flounder, Starry	19,565	77,398	145,986	95,954	35,800	69,915	9,943	14,898	22,880	72,720	68,873	2,060	635,992
Hake	2,358	5,865	3,138	11,193	10,465	4,026	3,515	1,675	2,025	4,225	10,559	9,418	68,462
Halibut, California	840	1,453	1,450	479	113	366	1,535	2,018	2,422	4,339	2,542	905	18,462
Halibut, Northern			4,672	13,796	32,282	24,166	13,691	7,315	4,837	3,593	80		104,432
Herring, Pacific	273,900	158,890	104,945								28,470	225,885	792,090
Kingfish		135	265	607	1,428	2,293	5,017	3,035	625			53	13,458
Mackerel, Pacific		105							4,460	11,325	375		16,265
Perch	9,098	16,071	30,169	20,019			6,497	13,036	13,231	9,056	8,390	6,757	132,324
Rockfish	36,641	37,869	94,331	90,464	52,604	82,624	105,206	78,312	108,379	80,328	65,230	54,386	886,374
Sablefish	9,412	783	13,436	35,647	163,021	256,384	76,605	33,461	60,256	58,632	5,958	480	714,075
Salmon					3,453	9,132	205,437	835,765					1,053,787
Sand Dab	38,740	52,848	49,060	75,891	66,555	50,336	66,478	31,103	41,081	64,052	45,682	43,093	624,919
Sardine	3,135,275	2,864,967	251,275	263,275	383,483	376,860	552,580	502,000	3,626,245	9,046,009	8,783,020	7,007,650	36,792,639
Sea-bass, White				26			240	27	114				407
Shad				165									165
Shark	26,700	39,188	23,817	4,991	290	265	925	2,907	4,530	5,320	19,968	30,869	159,770
Skate	26,181	38,923	31,128	23,898	13,960	8,000	6,400	7,643	12,295	23,800	26,625	36,561	255,414
Smelt	13,938	34,153	58,191	46,221	29,731	31,233	30,220	30,782	13,536	15,838	10,976	8,217	323,036
Sole	747,747	654,939	807,781	811,186	773,661	667,531	575,581	673,382	680,013	681,456	649,879	792,062	8,515,218
Striped Bass		1,444	16,768	5,941	7,078								31,231
Tomcod		70	405	20								190	685
Turbot	1,160	3,390	12,375	17,580	3,861	1,972	4,215	3,520	2,359	4,863	4,303	2,715	62,313
Whitebait	687	3,464	5,574	5,508	7,530	3,913	652	1,234	79		467	1,634	30,742
Miscellaneous Fish	12,585	8,929	20,938	24,616	20,372	23,975	22,635	18,770	10,506	15,855	11,560	14,317	205,058
Amphibian:													
Frog				20									20
Crustacean:													
Crab	403,530	403,172	432,336	385,660	358,082	293,792	157,712				600,210	462,496	3,496,990
Shrimp	47,276	49,226	68,022	106,735	181,694	587,169	843,121	774,744	223,898	269,249	184,593	109,113	3,444,840
Mollusk:													
Abalone					500	1,100	4,200	3,425	3,200	3,050	1,400	900	17,775
Clam, Cockle	6,532	8,448	10,713	7,715	7,717	4,902	3,412	3,701	943	650	125	34	54,892
Clam, Gaper	150	212	210	216	190	312	338	168	140	40	100	56	2,132
Clam, Soft-shell	14,158	14,603	14,302	12,210	13,181	12,161	13,200	14,088	14,195	10,301	10,168	10,838	153,405
Clam, Washington	120	142	167	168	128	230	205	211	190	42	88	89	1,780
Octopus	876	447	2,644	2,482	3,535	5,668	3,764	1,715	1,102	225	853	687	23,998
Oyster, Eastern	55,691	27,463	32,892	25,527	20,027	13,985	14,036	15,446	26,360	25,597	36,880	52,778	346,682
Oyster, Japanese		8,603	21,557	29,229	21,291	19,599	17,786	21,641	14,488	16,095	26,099	35,657	232,045
Oyster, Native	90			235	403	7,010	9,714	2,683	215		100		20,450
Snail		200		400									600
Total pounds	4,903,852	4,550,138	2,320,698	2,176,188	2,249,483	2,636,972	2,845,125	3,183,605	4,992,330	10,506,536	10,646,417	8,923,939	59,935,283

LANDINGS—REGION 50, MONTEREY, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Anchovy	180		2,185	1,450	4,180	3,280	29,895	31,010	3,910	165	100		76,355
Cabezone	15		300	48	1,300	1,120	3,227	2,047	369	280	736	468	9,910
Cultus, Pacific	7,665	7,474	6,814	6,667	8,828	6,333	8,298	8,681	7,188	10,450	17,867	7,101	103,366
Flounder, Starry	548	2,488	1,329	438	105	296	574	1,367	348	1,161	1,647	1,042	11,343
Hake						52							52
Halibut, California	1,237	4,695	6,581	5,909	4,601	2,371	3,789	5,571	336	622	1,643	4,537	41,892
Herring, Pacific		1,755	9,050	695		30	200		19,000		11,430	5,120	47,280
Kingfish	28,822	21,691	22,046	18,930	8,193	23,483	15,041	4,179	17,612	36,420	23,708	29,886	250,011
Mackerel, Horse	1,207	2,372	4,897	2,158	4,214	2,125	1,591	40,419	56,950	30,045	200	246	146,424
Mackerel, Pacific	44,034	59,413	52,819	40,146	35,175	66,801	201,012	926,066	1,228,658	2,607,788	102,553	107,588	5,472,053
Perch	25		10,548	19,571	325		7,077	331		800	702	10	39,389
Pompano, California			22	5	21	154	37						239
Rockfish	115,134	194,702	240,044	166,705	174,398	203,236	150,493	170,891	180,349	124,351	205,688	224,368	2,150,359
Sablefish	42,878	54,238	15,514	22,130	37,704	39,918	28,875	64,626	103,323	32,076	53,863	58,974	554,119
Sand Dab	272	1,621	9,298	5,364	3,789	678	6,742	5,981	2,300	158	1,309	125	37,637
Salmon			11,863	64,123	79,940	31,886	31,888						219,700
Sardine	58,395,577	26,962,619	22,970	140,690	123,800	173,590	56,810	5,820,775	70,711,232	74,069,965	81,872,287	57,800,272	376,150,587
Sea-bass, Black							12						12
Sea-bass, White		33	127	79			411	429		71			1,150
Sea-trout										5			5
Shad		27		30									57
Shark			350										350
Skate	307	475	6,167	4,027	1,219	2,247	3,901	1,541	170	240	522	616	21,432
Smelt	9,186	2,400	3,074	4,952	17,447	28,040	30,764	30,665	38,440	29,151	14,440	4,464	213,023
Sole	352	857	30,569	36,850	32,193	17,916	5,153	2,738	4,778	1,323	1,985	1,075	135,789
Tuna, Albacore									346,917	336,525			683,442
Tuna, Bonito												345	345
Turbot		69	125	3,642	4,672	1,060					20	92	9,680
Whitebait	156	35	556	1,196	450	6,964	1,401	284	56		575		11,673
Miscellaneous Fish	200					35			122				357
Curstacean:													
Crab	13,154	1,216	4,076	3,286	1,818	192	182				2,586	170	26,680
Prawn			63	263	551	310	249	21			224	670	2,351
Mollusk:													
Abalone	42,450		160,500	356,500	372,750	22,000	464,550	393,250	390,950	241,225	198,200	13,825	2,656,200
Clam, Pismo	2,674	2,208	2,738	1,625					4,137	4,373	3,520	2,006	23,281
Octopus	1,798	1,537	4,147	5,052	5,399	7,470	7,386	6,977	4,301	2,252	4,098	4,945	55,362
Oyster, Japanese				3,000	8,500	7,650		11,260	17,220	7,000	3,700	9,000	67,330
Oyster, Native								300	2,190	60			2,550
Squid	57,720	41,722	79,065	65,860	277,215	46,565	42,468	26,685	17,995	15,718	556	111,533	783,102
Total pounds	58,765,591	27,363,647	707,837	981,391	1,208,787	695,802	1,102,026	7,556,094	73,158,851	77,552,224	82,524,159	58,388,478	390,004,887

LANDINGS—REGION 60, SANTA BARBARA, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Barracuda	3,541	426	4,035	1,516					16,143	11,243	4,835		41,739
Cabezone			46									34	80
Cultus, Pacific	22		26	15	153	35	20		40	20	100	94	525
Flounder, Starry							10						10
Halibut, California	26,109	20,122	20,128	17,699	16,845	31,206	22,307	25,724	18,447	16,048	12,830	12,499	239,964
Herring, Pacific	82											345	427
Mackerel, Horse		240											240
Mackerel, Pacific	1,335	2,496	590	12		787	2,893	771	9,093	13,944	6,397	4,315	42,633
Perch	208	251	165	2,871			396	22	428	35	87	28	4,491
Rock Bass	144	777	1,241	1,794	1,238	4,808	1,231	120	338	1,013	616	404	13,724
Rockfish	27,418	50,526	44,249	26,146	23,647	20,314	56,996	37,395	24,798	27,053	26,495	26,620	391,657
Sablefish				950	665	63	795	1,080	55				3,608
Sardine		82	226		5		54	175	180			100	822
Sculpin		21	191	295	21								528
Sea-bass, Black		593					130	721	517	145	409		2,425
Sea-bass, White	1,070	659	6,588	11,995			21,876	9,239	2,309	6,386	4,088	2,262	66,472
Shark	4,169	1,930	5,966	5,764	2,734	3,079	4,802	1,117	1,051	2,740	3,142	1,131	37,625
Sheepshead	1,576	906	600	1,172	830	295	70	1,095	3,822	2,329	8,262	3,361	24,318
Skate							515	2,022		450	275	185	3,447
Smelt	222	2,224	1,464	4,190	3,251	4,437	3,388	1,311	541	222	315	233	21,798
Sole	24,551	30,255	52,829	47,964	47,896	17,385	48,680	60,325	36,187	64,640	36,643	35,995	503,350
Swordfish, Broadbill							7,410	6,293	5,582	4,717			24,002
Tuna, Albacore								165	198				363
Tuna, Bluefin										502			502
Tuna, Bonito	50								120	648	183	10	1,011
Tuna, Yellowfin												11	11
Turbot								8		1			9
Whitefish	215	2,942	803		492	403	20	180	389	5	710	347	6,506
Yellowtail				19									19
Miscellaneous Fish			109	113			16					151	389
Crustacean:													
Lobster, Spiny	9,870								27,920	36,139	15,649	19,913	109,491
Mollusk:													
Abalone	12,950		84,675	118,100	143,600	86,075	149,800	153,500	191,525	104,775	117,650	33,325	1,195,975
Clam, Pismo	9,406	10,367	12,221	13,270	12,597	13,241	19,798	18,756	12,988	12,730	11,721	11,479	158,574
Octopus											61		61
Total pounds	122,938	124,727	236,152	253,885	253,974	182,128	341,207	320,019	352,671	305,785	250,468	152,842	2,896,796

LANDINGS*—REGION 70, LOS ANGELES, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Anchovy			893	10,205	8,355	3,840	1,560	1,230	200	405	555	800	28,043
Barracuda	11,266	25,849	138,902	750,142			703,841	171,318	96,548	114,174	83,949	33,599	2,129,588
Cabezone										37	110		147
Cabrilla	1,377	725	6,646	43,939	8,475	7,646	1,682		67	12,256	26,976	722	110,511
Carp		2,975	2,450		12,558	9,578	9,453	11,002					48,016
Corbina, Mexican	10,261	14,608	33,980	51,416	2,044							3,772	116,081
Cultus, Pacific	78					8			703	165	67	304	1,325
Eel	42	9										20	71
Flying Fish				1,130	6,300	12,184	8,265	6,160	3,681	208			37,928
Grouper	790	430		2,538	6,593	290				422	9,615	480	21,158
Hake	490	760	52	187	1,984	65		43		145		1,603	5,329
Halibut, California	55,847	90,846	49,572	112,424	76,870	42,402	24,546	34,553	31,307	17,647	57,527	11,457	604,998
Halibut, Northern									1,357		1,006		2,363
Kingfish	41,910	43,358	67,691	46,548	46,345	46,017	31,026	29,762	40,498	35,997	35,312	36,711	501,175
Mackerel, Horse	139,683	40,640	12,185	29,829	1,131,225	2,966,467	124,465	985,690	2,912,796	610,184	385,699	496,943	9,835,806
Mackerel, Pacific	1,123,638	1,511,741	124,215	189,266	13,593,659	13,087,271	5,493,545	8,909,285	19,224,118	28,430,598	23,488,731	16,454,719	131,630,786
Mackerel, Spanish				1,997		180		100	195		1,919	65	4,456
Mullet				59	33	270			120			56	538
Perch	10,668	8,687	14,613	6,532	310	294	5,334	8,049	12,300	5,012	9,107	10,564	91,470
Pompano, California	80	89	46	93	69	7	816	1,874	659	757	859	236	5,585
Rock Bass	3,666	6,001	7,579	8,055	9,466	24,178	22,242	30,338	15,845	10,613	11,759	5,293	155,035
Rockfish	53,622	92,832	116,136	156,213	108,004	135,936	30,140	29,767	25,076	18,073	18,614	51,399	835,812
Sablefish	64,732	54,478	106,219	90,676	65,120	45,080	1,908	5,521	14,179	19,906	15,793	35,533	519,145
Salmon					15								15
Sand Dab	1,747	2,862	2,419	1,142	607	796	666	642	396	525	559	630	12,991
Sardine	91,579,180	106,889,567	32,909,509	11,985	5,645	5,528	4,045	4,370	11,245	12,129	29,025,188	31,542,551	292,000,942
Sculpin	2,638	2,892	3,935	4,848	4,834	9,497	5,015	6,759	6,816	5,007	6,930	2,460	61,631
Sea-bass, Black	35,784	31,869	30,524	42,640	27,131	61,134	423	12,739	30,969	50,988	65,099	26,928	416,228
Sea-bass, Totuava	234,440	268,790	380,982	14,974	139,002	18,667				41,776	186,765	174,749	1,460,145
Sea-bass, White	4,407	14,711	2,617	302,706			148,523	207,734	58,905	16,915	4,326	7,997	768,841
Shark	12,797	19,251	20,555	44,905	46,269	58,116	12,193	22,196	22,750	18,904	10,985	5,911	294,832
Sheepshead	23,800	24,547	14,175	19,240	3,158	2,057	250	2,416	2,441	25,757	26,872	15,418	160,131
Skate	1,245	464	1,588	612	692	1,322	24	112	151	944	629	1,139	8,922
Smelt	27,900	22,034	30,937	15,392	16,270	14,567	14,501	18,995	20,074	33,400	34,914	37,462	286,446
Sole	718	795	1,824	1,047	1,182	619	152	108	149	215	362	333	7,504
Striped Bass			7										7
Swordfish, Broadbill					421	25,025	79,520	154,667	109,453	46,380	8,275		423,741
Swordfish, Marlin						455	2,179	7,519	3,881	639			14,673
Tuna, Albacore	31,344	103,872	446,053			366,910	654,878	360,673	565,770	1,134,407	653,014	419,474	4,736,395

Tuna, Bluefin					3,168,082	12,259,702	4,697,017	3,008,108	553,908	24,006	35		23,710,858
Tuna, Bonito	16,091	14,100	4,297	409,281	79,224	74,978	846,673	1,839,735	1,289,218	370,919	294,129	370,070	5,608,715
Tuna, Oriental									25,454		121,077		146,531
Tuna, Skipjack	543,993	331,828	795	107,299	153,098	355,061	252,351	840,064	472,427	1,379,240	640,782	1,040,461	6,117,399
Tuna, Yellowfin	589,481	1,126,948	1,840,921	2,319,055	2,126,433	3,380,014	1,300,376	2,232,808	1,085,686	2,181,394	807,932	1,620,390	20,611,438
Turbot	6			42			150	78				9	285
Whitefish	1,696	4,419	3,916	4,412	2,785	5,825		3,091	933	2,594	1,671	2,586	33,928
Yellowtail	84,774	87,715	152,450	247,876	219,741	111,085	192,295	504,245	473,650	59,615	93,830	11,801	2,239,077
Miscellaneous Fish	707	901	70	604	473	129	169	219	759	129	141	124	4,425
Crustacean:													
Crab, Rock	435	1,270	1,700	1,400	985	1,555	600	1,125	200	1,055	1,243	1,249	12,817
Lobster, Spiny	20,295	12,423	38,050	28,872					48,501	61,501	46,109	49,006	304,757
Shrimp	1					250							251
Mollusk:													
Abalone			150	100	63	25	83	25	100	75	200	150	971
Clam											5	158	163
Clam, Bean							16						16
Clam, Cockle	2,172	1,679	2,601	3,189	1,240	2,045	1,216	1,895	2,126	2,963	2,605	1,717	25,448
Clam, Jackknife												5	5
Mussel							10						10
Octopus			4	3						3	6		16
Squid	1,015	940			13,145	7,485	1,225	6,058	229		2,595	150	32,842
Whelks											220	265	485
Total pounds	94,734,816	110,857,905	36,571,258	5,082,873	21,087,905	33,144,560	14,673,373	19,461,073	27,165,840	34,748,079	56,184,096	52,477,469	506,189,247

*Importations of fresh fish from foreign countries included. See importation tables.

LANDINGS*—REGION 80, SAN DIEGO, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Barracuda	20,913	4,452	18,215	54,917			95,819	164,579	23,074	38,794	15,368	10,366	446,497
Cabrilla		855		386	3,094	29,934	306	4,185		92	16,092		54,944
Corbina, Mexican	200	645											845
Cultus, Pacific			1,344								210	640	2,194
Grouper			70		438	1,231	240	3,737			755	3,934	10,405
Halibut, California	54,471	58,066	81,096	39,664	31,506	41,966	42,865	76,597	52,028	64,192	88,695	39,401	670,547
Herring, Pacific	229										22,780	58,439	81,448
Kingfish	370	709	794	800	571	188	116	225	31	26	114	97	4,032
Mackerel, Horse					1,454								1,454
Mackerel, Pacific	146,836	10,715	12,990	1,098,499	1,522,354	1,151,465	1,391,112	815,948	5,990	1,438,108	1,164,095	507,346	9,265,458
Mackerel, Spanish								150					150
Mullet	45		51	234	1,075	3,807	3,564	1,224		474	1,336	1,376	13,186
Perch	29	116	170				983	2,397		11	389	162	4,257
Rock Bass	10,922	8,731	14,363	19,260	18,862	28,092	25,471	31,964	12,477	8,514	13,605	3,484	195,795
Rockfish	41,923	44,462	53,308	39,116	61,483	41,193	18,522	22,728	13,047	30,323	25,685	9,856	406,651
Sablefish	396	3,452	3,510	908	2,022	43	4,783				88		15,202
Sardine	4,179,238	3,992,971	481,666	1,525	180	1,061	545	150		60	572,060	4,872,743	14,102,259
Sculpin	203	995	389	66	348	1,802		265	64	1,074	1,586	598	7,390
Sea-bass, Black	19,609	1,139	20,146	1,082	14,734	19,664	15,291	12,082	1,575	69,718	17,467	20,587	213,094
Sea-bass, Short-fin	132		4	206	1,527	1,168	148	47	20		57	41	3,350
Sea-bass, Totuava	10,087	14,509											24,596
Sea-bass, White	33	897	416	1,745			61,111	103,951	49,547	5,692	2,837	3,410	229,549
Shark	306	1,363	1,224	3,805	6,487	4,072	3,176	18,018	14,532	1,917	960	6,684	62,544
Sheepshead	699		116	70	26	50		79	496	382	1,463	192	3,573
Skate		959	1,496	1,989	1,992	3,757	3,104	752	1,322	1,050	608	878	17,907
Smelt	2,195	45	359				4	1,268	1,129	993	411	12	6,407
Sole	569	221	168	30	81					85	62		1,216
Swordfish, Broadbill		184	327		84	6,161	29,934	83,376	69,596	30,917	955		221,534
Swordfish, Marlin							330	2,969	689	407			4,395
Tuna, Albacore							228,660	7,677	1,184	18,216	2,837		258,574
Tuna, Bluefin					72,182	374,385	253,264	470,891	289,970	948	41	42	1,461,723
Tuna, Bonito	1,164	61,524	100,937	361,491	89,202	52,206	233,970	272,670	178,809	89,098	121,306	724,036	2,286,413
Tuna, Skipjack	58,442	109,240	188,392	916,891	851,231	941,324	388,623	2,011,406	4,182,319	2,403,953	1,070,565	564,169	13,686,555
Tuna, Yellowfin	2,204,451	1,798,604	3,657,367	3,458,624	5,826,190	5,075,472	4,297,193	5,284,870	4,387,061	4,825,233	4,152,363	6,715,256	51,682,684
Whitefish	3,471	929	5,042	2,231	1,575	570	360	865	195	524	1,575		17,337
Yellowtail	53,665	71,265	259,547	457,661	948,114	874,272	954,753	895,541	565,733	532,279	181,393	115,399	5,909,622
Crustacean:													
Lobster, Spiny	125,562	108,539	159,291	79,424	2,200	3,975	20,625	12,073	37,824	51,695	179,747	149,593	930,548
Mollusk:													
Clam, Pismo				1,581	3,744	8,100	800						14,225
Reptile:													
Turtle								1,722					1,722
Total pounds	6,936,225	6,295,538	5,067,789	6,542,205	9,462,756	8,665,958	8,075,672	10,304,406	9,888,712	9,614,775	7,657,505	13,808,741	102,320,282

*Importations of fresh fish from foreign countries included. See importation tables.

LANDINGS*—STATE OF CALIFORNIA, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Anchovy	180		5,128	22,105	12,535	10,917	47,855	46,440	25,910	5,795	655	1,450	178,970
Barracuda	35,720	30,727	161,152	806,575			799,660	335,897	135,765	164,211	104,152	43,965	2,617,824
Cabezone	15		546	48	1,300	1,120	3,227	2,047	369	517	846	502	10,537
Cabrilla	1,377	1,580	6,646	44,325	11,569	37,580	1,988	4,185	67	12,348	43,068	722	165,455
Carp	13,667	16,799	21,997	16,384	19,415	16,509	14,928	11,744	303	132	7,124	13,176	152,178
Catfish	8,922	7,817	25,425	35,332	436	597	508	1,623	56,362	68,757	50,122	33,723	289,624
Corbina, Mexican	10,461	15,253	33,980	51,416	2,044							3,772	116,926
Cultus, Pacific	32,743	76,912	89,906	87,249	50,633	88,514	113,442	105,915	109,779	125,525	107,951	28,886	1,017,455
Eel	42	9		20				5				20	96
Flounder, Starry	24,409	81,709	148,660	96,392	35,905	70,211	10,527	16,265	23,228	73,881	71,277	3,649	656,113
Flying Fish				1,130	6,300	12,184	8,265	6,160	3,681	208			37,928
Grouper	790	430	70	2,538	7,031	1,521	240	3,737		422	10,370	4,414	31,563
Hake	2,848	6,625	3,190	11,380	12,449	4,143	3,515	1,718	2,025	4,370	10,559	11,021	73,843
Halibut, California	138,504	175,182	158,827	176,175	129,935	118,311	95,042	144,463	104,540	102,848	163,237	68,799	1,575,863
Halibut, Northern			21,095	105,875	191,711	110,457	187,326	91,461	65,870	88,832	5,939		868,566
Hardhead	11,371	8,749	12,270	13,103	8,200	6,200	1,425		18	3,580	5,379	7,749	78,044
Herring, Pacific	278,830	163,153	113,995	695		30	200		23,405		62,680	290,297	933,285
Kingfish	71,102	65,884	90,796	66,885	56,537	71,981	51,200	37,201	58,766	72,443	59,134	66,747	768,676
Mackerel, Horse	140,890	43,252	17,082	31,987	1,136,893	2,968,592	126,056	1,026,109	2,969,746	640,229	385,899	497,189	9,983,924
Mackerel, Pacific	1,315,843	1,584,470	190,614	1,327,923	15,151,188	14,306,324	7,088,562	10,652,070	20,472,326	32,501,763	24,762,151	17,073,968	146,427,202
Mackerel, Spanish				1,997		180		250	195		1,919	65	4,606
Mullet	45		51	293	1,108	4,077	3,564	1,224	120	474	1,336	1,432	13,724
Perch	20,295	27,275	59,306	52,194	635	294	20,287	23,835	25,959	14,914	19,013	17,600	281,607
Pike	39	329	736	444	10			42	12	19			1,631
Pompano, California	80	89	68	98	90	161	853	1,874	659	757	859	236	5,824
Rock Bass	14,732	15,559	23,183	29,109	29,566	57,078	48,944	62,422	28,660	20,140	25,980	9,181	364,554
Rockfish	278,840	427,237	563,594	498,179	428,263	489,620	382,803	353,049	367,542	310,042	359,274	372,731	4,831,174
Sablefish	125,596	121,781	164,841	168,141	380,718	365,993	191,517	314,832	428,607	338,151	145,993	102,502	2 848,672
Salmon	2,058	9,498	20,451	259,576	397,687	149,860	1,125,436	2,258,995	1,437,514		495	410	5,661,980
Sand Dab	40,759	57,381	60,777	82,397	70,951	51,810	73,886	37,726	43,777	64,735	47,550	43,848	675,597
Sardine	172,629,629	143,672,006	33,665,646	417,475	513,113	557,039	614,034	9,063,370	88,945,302	103,765,963	153,837,455	121,831,516	829,512,548
Sculpin	2,841	3,908	4,515	5,209	5,203	11,299	5,015	7,024	6,880	6,081	8,516	3,058	69,549
Sea-bass, Black	55,393	33,511	50,670	43,722	41,865	80,798	15,856	25,542	33,061	120,851	82,975	47,515	631,759
Sea-bass, Short-fin	132		4	206	1,527	1,168	148	47	20		57	41	3,350
Sea-bass, Totuava	244,527	283,299	380,982	14,974	139,002	18,667				41,776	186,765	174,749	1,484,741
Sea-bass, White	5,510	16,210	9,748	316,551			232,161	321,380	110,875	29,064	11,251	13,669	1,066,419
Sea-trout		25								5			30
Shad		2,368	87,404	795,974	716,505								1,602,251
Shark	43,972	61,732	51,912	59,465	55,780	65,532	21,096	44,238	42,863	28,881	35,055	44,595	555,121
Sheepshead	26,075	25,453	14,891	20,482	4,014	2,402	320	3,590	6,759	28,468	36,597	18,971	188,022
Skate	27,733	40,821	40,379	30,526	17,863	15,326	13,944	12,070	13,938	26,484	28,659	39,379	307,122
Smelt	56,504	63,528	94,317	70,817	66,699	79,473	82,487	84,495	75,299	83,308	63,520	55,033	875,480
Sole	774,392	687,430	893,256	897,077	855,013	703,578	629,571	736,570	721,167	747,763	688,931	829,515	9,164,263
Split-tail	9,042	6,615	5,830	3,152	1,650	1,327	180	579	945	309	2,649	5,287	37,565
Striped Bass		55,509	130,661	231,882	84,028								502,080
Sucker	7,467	4,915	7,569	3,021	2,075	2,275	1,100			17	5,805	10,124	44,368

Swordfish, Broadbill		184	327		505	31,186	116,864	244,336	184,631	82,014	9,230			669,277
Swordfish, Marlin						455	2,509	10,488	4,570	1,046				19,068
Tomcod		70	405	20									190	685
Tuna, Albacore	31,344	103,872	446,053			366,910	883,557	368,515	914,069	1,489,148	655,851	419,474		5,678,793
Tuna, Bluefin					3,240,264	12,634,087	4,950,281	3,478,999	843,878	25,456	76	42		25,173,083
Tuna, Bonito	17,305	75,624	105,234	770,772	168,426	127,184	1,080,643	2,112,405	1,468,147	460,665	415,618	1,094,461		7,896,484
Tuna, Oriental									25,454		121,077			146,531
Tuna, Skipjack	602,435	441,068	189,187	1,024,190	1,004,329	1,296,385	640,974	2,851,470	4,654,746	3,783,193	1,711,347	1,604,630		19,803,954
Tuna, Yellowfin	2,793,932	2,925,552	5,498,288	5,777,679	7,952,623	8,455,486	5,597,569	7,517,678	5,472,747	7,006,627	4,960,295	8,335,657		72,294,133
Turbot	1,166	3,459	12,500	21,264	8,533	3,032	4,365	3,606	2,359	4,864	4,323	2,816		72,287
Whitebait	12,080	18,272	22,597	24,950	27,394	31,907	17,166	7,088	215		1,042	1,634		164,345
Whitefish	5,382	8,290	9,761	6,643	4,852	6,798	380	4,136	1,517	3,123	3,956	2,933		57,771
Yellowtail	138,439	158,980	411,997	705,556	1,167,855	985,357	1,147,048	1,399,786	1,039,383	591,894	275,223	127,200		8,148,718
Miscellaneous Fish	13,549	9,971	21,979	26,029	27,319	24,906	29,210	19,085	11,444	16,484	14,313	15,257		229,546
Amphibian:														
Frog				20										20
Crustacean:														
Crab	435,126	421,732	453,204	400,060	375,666	312,844	183,268	24,446			602,796	471,046		3,680,188
Crab, Rock	435	1,270	1,700	1,400	985	1,555	600	1,125	200	1,055	1,243	1,249		12,817
Lobster, Spiny	155,727	120,962	197,341	108,296	2,200	3,975	20,625	12,073	114,245	149,335	241,505	218,512		1,344,796
Prawn			63	263	551	310	249	21			224	670		2,351
Shrimp	47,277	49,226	68,022	106,735	181,694	587,419	843,121	774,744	223,898	269,249	184,593	109,113		3,445,091
Mollusk:														
Abalone	55,400		245,325	474,700	516,913	109,200	618,633	550,200	585,775	349,125	317,450	48,200		3,870,921
Clam							34				5	158		197
Clam, Bean							16							16
Clam, Cockle	8,704	10,127	13,314	10,904	8,957	6,947	4,628	5,596	3,438	3,834	2,784	1,860		81,093
Clam, Gaper	534	620	978	720	190	312	338	168	140	40	100	56		4,196
Clam, Jackknife												5		5
Clam, Pismo	12,080	12,575	14,959	16,476	16,341	21,341	20,598	18,756	17,125	17,103	15,241	13,485		196,080
Clam, Razor							40							40
Clam, Soft-shell	14,158	14,603	14,302	12,210	13,181	12,161	13,200	14,088	14,195	10,301	10,168	10,838		153,405
Clam, Washington	3,612	4,799	6,089	2,164	128	230	205	211	7,292	7,392	5,316	4,604		42,042
Mussel							10							10
Octopus	2,757	2,071	7,821	7,775	8,934	13,138	11,150	8,692	5,403	2,534	5,297	5,632		81,204
Oyster, Eastern	55,691	27,463	32,892	25,527	20,027	13,985	14,036	15,446	26,360	25,597	36,880	52,778		346,682
Oyster, Japanese		8,603	21,557	32,229	29,791	27,249	17,786	32,901	31,708	23,095	29,799	44,657		299,375
Oyster, Native	90			235	403	7,010	9,714	2,983	2,405	60	100			23,000
Snail		200		400										600
Squid	58,735	42,662	79,065	65,860	290,360	54,050	43,693	32,743	18,224	15,718	3,151	111,683		815,944
Whelks											220	265		485
Reptile:														
Turtle								1,722						1,722
Total pounds	180,919,333	152,357,285	45,307,130	16,523,575	35,715,867	45,618,567	28,289,678	45,353,701	132,015,882	153,833,015	191,070,420	154,470,611		1,181,475,064

*Importations of fresh fish from foreign countries included. See importation tables.

FRESH FISH IMPORTATIONS* FROM FOREIGN COUNTRIES LANDED IN REGION 70, LOS ANGELES, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Barracuda		7,898	255	1,005				309	34,199	101,727	70,111	33,596	249,100
Cabrilla	1,377	725	6,646	43,939	8,475	7,646	1,682		67	12,256	26,976	722	110,511
Corbina, Mexican	10,261	14,608	33,980	51,416	2,044							3,772	116,081
Grouper	790	430		2,538	6,593	290				422	9,615	480	21,158
Halibut, California	21,254	35,073		51,908	21,209	35	17,745	22,579	24,154	450	45,550		239,957
Mackerel, Spanish				1,997		180		100	195		1,919	65	4,456
Rock Bass		132	839	1,515			357		1,012	118	615	398	4,986
Rockfish			10		10,172	1,277							11,459
Sea-bass, Black	35,259	30,778	29,813	41,698	26,871	59,366	55	10,033	30,771	50,271	64,959	26,701	406,575
Sea-bass, Totuava	234,440	268,790	380,982	14,974	139,002	18,667				41,776	186,765	174,749	1,460,145
Sea-bass, White	42	90		218			1,748	162,204	53,478	11,679	581	536	230,576
Shark		36	95	250							285	315	981
Sheepshead		86	268										354
Smelt		200										140	340
Sole		75											75
Swordfish, Broadbill						170		9,903		3,214			13,287
Swordfish, Marlin								510					510
Tuna, Albacore	31,344	103,872	446,053			366,910	52,534	97,139	441,212	662,654	610,159	419,474	3,231,351
Tuna, Bluefin					3,167,477	1,408,821	920,143	189,031	169,670	17,050			5,872,192
Tuna, Bonito	2,116	3,629	4,247	859	491		596,594	1,819,204	1,275,268	361,363	239,496	7,697	4,310,964
Tuna, Oriental									25,454		121,077		146,531
Tuna, Skipjack	543,993	331,828	795	107,299	153,098	355,061	252,351	819,762	434,026	1,379,102	640,782	1,040,461	6,058,558
Tuna, Yellowfin	589,481	1,126,948	1,840,921	2,319,055	2,126,433	3,379,929	1,300,285	2,221,309	1,056,569	2,180,383	807,701	1,620,326	20,569,340
Whitefish		579	1,324	3,167	1,060							678	6,808
Yellowtail	84,774	87,671	152,137	52,652	11,226	111,060	192,277	503,797	429,887	41,934	93,633	11,792	1,772,840
Miscellaneous Fish								165	533				698
Crustacean:													
Lobster, Spiny	2,926	10,813	38,050	28,872						2,973	12,678	28,855	125,167
Total pounds	1,558,057	2,024,261	2,936,415	2,723,362	5,674,151	5,709,412	3,335,771	5,856,045	3,976,495	4,867,372	2,932,902	3,370,757	44,965,000

*These importations are included in tables of landings. They include fish caught by California boats in foreign waters as well as frozen tuna imported for canning in California plants.

FRESH FISH IMPORTATIONS* FROM FOREIGN COUNTRIES, LANDED IN REGION 80, SAN DIEGO, 1935

Species	January	February	March	April	May	June	July	August	September	October	November	December	Total pounds
Barracuda	17,658	3,232	10,269	15,014			76,200	162,777	21,851	35,696	12,067	10,013	364,777
Cabrilla		855		386	3,094	29,934	306	4,185		92	16,092		54,944
Corbina, Mexican	200	645											845
Cultus, Pacific			394								55	460	909
Grouper			70		438	1,231	240	3,737			755	3,934	10,405
Halibut, California	44,375	41,729	61,896	19,810	6,689	14,464	42,822	76,547	51,883	53,116	85,150	27,134	525,615
Kingfish				14		11	55	50	8				138
Mackerel, Pacific			1,429	186,734	36,112	8,882	326,175	597,177	469			3,926	1,160,904
Mackerel, Spanish								150					150
Perch							700	2,327					3,027
Rock Bass	57	117	717	2,347	3,480	7,891	3,995	7,510	110	521	2,115	596	29,456
Rockfish	15,484	25,386	29,684	31,125	35,388	23,904	11,623	20,631	9,763	24,284	1,980	5,777	235,029
Sablefish			1,832	240	1,254		4,304				88		7,718
Sardine			405	1,525	180	1,061	545	150					3,866
Sculpin					19	1,722							1,741
Sea-bass, Black	19,576	1,074	19,823	1,044	14,522	19,612	15,138	11,846	1,005	69,509	16,990	17,822	207,961
Sea-bass, Totuava	10,087	14,509											24,596
Sea-bass, White		160	399	1,044			42,640	91,235	44,000	5,037	1,976	452	186,943
Shark		251	351	65	390	822	1,945	3,554		1,136			8,514
Sheepshead	223			70	26	50		31			252	140	792
Skate		270	55		131	1,370	1,600	480	250				4,156
Smelt	1,545		266					130	141	14			2,096
Sole			64	6									70
Swordfish, Broadbill		184	327		84				36,933	2,757	749		41,034
Swordfish, Marlin									134				134
Tuna, Albacore							59,915	100	478	700			61,193
Tuna, Bluefin						30,699	83,716	410,845	279,818				805,078
Tuna, Bonito	1,119	11,660	15,936	177,176	32,595	16,599	56,637	216,989	178,422	83,600	104,361	426,686	1,321,780
Tuna, Skipjack	58,442	109,240	188,392	916,891	851,231	941,324	388,623	2,005,777	2,839,106	1,903,720	1,070,565	564,169	11,837,480
Tuna, Yellowfin	2,204,451	1,798,604	3,657,367	3,458,624	5,826,190	5,075,472	4,297,193	5,274,361	3,972,756	4,763,149	4,152,363	6,715,256	51,195,786
Whitefish	3,006	848	1,361	2,115	1,420	570		865		520	223		10,928
Yellowtail	53,553	70,081	257,484	444,995	881,518	874,272	951,039	895,413	556,701	521,455	173,456	113,322	5,793,289
Crustacean: Lobster	122,232	108,464	159,291	79,424	2,200	3,975	20,625	12,073	11,027	19,206	165,819	143,632	847,968
Mollusk: Clam, Pismo				1,581	3,744	8,100	800						14,225
Reptile: Turtle								1,722					1,722
Total pounds	2,552,008	2,187,309	4,407,812	5,340,230	7,700,705	7,061,965	6,386,836	9,800,662	8,004,855	7,484,512	5,805,056	8,033,319	74,765,269

*These importations are included in tables of landings. They include fish caught by California boats in foreign waters imported for canning in California plants.

FRESH FISH IMPORTATIONS* BY POINT OF ORIGIN, 1935

Species	Gulf of California	West Coast Lower California	International waters south U. S. boundary (definite origin unknown)	Mexican Mainland and Central America	Japan	Total pounds
Barracuda		613,877				613,877
Cabrilla	43,960	119,032	2,463			165,455
Corbina, Mexican	116,776		150			116,926
Cultus, Pacific		909				909
Grouper	200	26,775	4,588			31,563
Halibut, California		744,318	21,254			765,572
Kingfish		138				138
Mackerel, Pacific		1,160,904				1,160,904
Mackerel, Spanish		4,606				4,606
Perch		3,027				3,027
Rock Bass		34,442				34,442
Rockfish		246,488				246,488
Sablefish		7,718				7,718
Sardine		3,866				3,866
Sculpin		1,741				1,741
Sea-bass, Black	996	578,381	35,159			614,536
Sea-bass, Totuava	1,484,741					1,484,741
Sea-bass, White		417,477	42			417,519
Shark		9,495				9,495
Sheepshead		1,146				1,146
Skate		4,156				4,156
Smelt		2,436				2,436
Sole		145				145
Swordfish, Broadbill		54,237	84			54,321
Swordfish, Marlin		644				644
Tuna, Albacore		61,279			3,231,265	3,292,544
Tuna, Bluefin		6,676,966	304			6,677,270
Tuna, Bonito		5,559,687	73,057			5,632,744
Tuna, Oriental					146,531	146,531
Tuna, Skipjack	347,912	3,260,350	11,124,532	556,476	2,606,768	17,896,038
Tuna, Yellowfin	806,558	6,345,701	54,257,118	10,355,749		71,765,126
Whitefish		17,736				17,736
Yellowtail		7,484,046	82,010	73		7,566,129
Miscellaneous Fish		698				698
Crustacean:						
Lobster, Spiny		889,501	83,634			973,135
Mollusk:						
Clam, Pismo		14,225				14,225
Reptile:						
Turtle		1,722				1,722
Total pounds	2,801,143	34,347,869	65,684,395	10,912,298	5,984,564	119,730,269

*These importations have been included in tables of landings. The fish from Mexico and Central America are caught by California boats. The tuna from Japan are imported frozen for canning in California plants.

COMMON AND SCIENTIFIC NAMES OF FISHES, CRUSTACEANS AND MOLLUSKS

FISHES

Common name	*Scientific name*
Anchovy	Anchoviella compressa
	Anchoviella delicatissima
	Engraulis mordax
Barracuda	Sphyraena argentea
Cabezone	Scorpaenichthys marmoratus
Cabrilla	Epinephelus analogus
	Various species of Mycteroperca
Carp	Cyprinus carpio
Catfish	Ameiurus catus
	Ameiurus nebulosus
Corbina, Mexican	Cynoscion othonopterus
	Cynoscion xanthulus
	Micropogon ectenes
	Other members of the Sciaenidae
Cultus, Pacific	Ophiodon elongatus
Dolphin	Coryphaena hippurus
Eel, Blenny	Cebidichathys violaceus
	Xiphister mucosus
	Other stichaeids and blenniids
Eel, Moray	Gymnothorax mordax
Flounder, Starry	Platichthys stellatus
Flying Fish	Cypselurus californicus
Grouper	Various species of Mycteroperca
Hake	Merluccius productus
Halibut, California	Paralichthys californicus
Halibut, Northern	Hippoglossus stenolepis
Hardhead	Orthodon microlepidotus
	Mylopharodon conocephalus
Herring, Pacific	Clupea pallasii
Kingfish	Genyonemus lineatus
Small percentage of Queenfish	Seriphus politus
Mackerel, Horse	Trachurus symmetricus
Mackerel, Pacific	Pneumatophorus diego
Mackerel, Spanish	Scomberomorus sierra
Mullet	Mugil cephalus
Perch:	
Halfmoon	Medialuna californiensis
Opal-eye	Girella nigricans
Salt-water	Various members of the Embiotocidae
Sargo	Anisotremus davidsoni
Pike	Ptychocheilus grandis
Pompano, California	Palometa simillima
Pompano, Mexican	Various species of Trachinotus, and possibly other carangids
Rock Bass	Paralabrax clathratus
	Paralabrax nebulifer
Rockfish	All species of Sebastodes and Sebastolobus found in California waters
Sablefish	Anoplopoma fimbria
Salmon	Oncorhynchus tschawytscha
	Oncorhynchus kisutch
Sand Dab	Citharichthys stigmaeus
	Citharichthys sordidus

Common name	*Scientific name*
Sardine	Sardinops caerulea
Saury	Cololabis brevirostris
Sculpin	Scorpaena guttata
Sea-bass, Black	Stereolepis gigas
Sea-bass, Short-fin	Cynoscion parvipinnis
Sea-bass, Totuava	Cynoscion macdonaldi
Sea-bass, White	Cynoscion nobilis
Sea-trout, California	Hexagrammos decagrammus
Shad	Alosa sapidissima
Shark	Alopias vulpes
	Galeorhinus zyopterus
	Isurus glaucus
	Mustelus californicus
	Rhinotriacis henlei
	Squalus suckleyi
	Triakis semifasciata
	Small percentage of other species
Sheepshead	Pimelometopon pulcher
Skate	Raja binoculata
	Raja inornata
	Raja rhina
	And other species
Smelt	Atherinops affinis
	Atherinopsis californiensis
	Hypomesus pretiosus
	Leuresthes tenuis
	Small percentage of other Osmeridae
Sole	Eopsetta jordani
	Glyptocephalus zachirus
	Parophrys vetula
	Several other pleuronectids
Split-tail	Pogonichthys macrolepidotus
Striped Bass	Roccus saxitalis
Sucker	Catostomus occidentalis
Swordfish, Broadbill	Xiphias gladius
Swordfish, Marlin	Makaira mitsukurii
Tomcod	Microgadus proximus
Tuna, Albacore	Germo alalunga
Tuna, Bluefin	Thunnus thynnus
Tuna, Bonito	Sarda chiliensis
Tuna, Oriental	Thunnus orientalis
Tuna, Skipjack	Katsuwonus pelamis
Tuna, Yellowfin	Neothunnus macropterus
Turbot	Hypsopsetta guttulata
	Pleuronichthys decurrens
	Pleuronichthys verticalis
	Possibly a small percentage of other pleuronectids
Whitebait	Allosmerus attenuatus
	Spirinchus starksi
	Young of several species of fishes
Whitefish	Caulolatilus princeps
Yellowtail	Seriola dorsalis

CRUSTACEANS

Crab	Cancer magister
Crab, Rock	Cancer antennarius
	Cancer anthonyi
	Cancer productus
Lobster, Spiny	Panulirus interruptus
Prawn	Pandalus platyceros
Shrimp	Crago franciscorum and C. nigricauda from California waters
	Other species from Mexican waters

MOLLUSKS

Common name	*Scientific name*
Abalone	Haliotis fulgens
	Haliotis rufescens
Clam, Bean	Donax gouldii
Clam, Cockle	Paphia staminea
	Species of Chione
Clam, Gaper	Schizothaerus nuttalli
Clam, Jackknife	Tagelus californianus
Clam, Pismo	Tivela stultorum
Clam, Razor	Siliqua patula
Clam, Soft-shell	Mya arenaria
Clam, Washington	Saxidomus giganteus
	Saxidomus nuttalli
Mussel	Mytilus californianus
	Mytilus edulis
Octopus	Polypus hongkongensis
	Polypus bimaculatus
Oyster, Eastern	Ostrea virginica
Oyster, Japanese	Ostrea gigas
Oyster, Native	Ostrea lurida
Snail	Various species of gastropods
Squid	Dosidicus gigas
	Loligo opalescens
	Small percentage of other species
Whelk	Various species of gastropods

—Compiled by Frances N. Clark.

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In accordance with the objective of this publication, intended as a reference book, the following list of fisheries literature is cited for those who wish to pursue further the course of any of the commercial species of fishes. During the past twenty years in connection with the program of fisheries research as conducted by the California State Fisheries Laboratory, individual studies have been made of the more important commercial species and the findings published in a series of Fish Bulletins. Although not mentioned in each of the articles appearing in this publication, each author has made general usage of the four former "Catch bulletins" (Fish Bulletins 15, 20, 30 and 44) and of the "Handbook of common commercial and game fishes of California" (Fish Bulletin 28). We would call attention also to the other publications of the Division of Fish and Game which contain valuable information—these are "California Fish and Game," published quarterly; "Statistical Reports on Fresh and Canned Fishery Products," published annually; the "Biennial Reports" of the California Fish and Game Commissioners; and the "Fish and Game Code".

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